ARCHIVES OF OPHTHALMOLOGY.

ON THE DETECTION OF THE PRESENCE AND LOCATION OF STEEL AND IRON FOREIGN BODIES IN THE EYE BY THE INDICATION OF A MAGNETIC NEEDLE.*

By THOMAS R. POOLEY, of New York.

WHILE on a visit to my brother, Dr. J. H. Pooley, last February, he mentioned to me that he had been experimenting on the application of magnetism, to detect the presence of steel or iron foreign bodies broken off in the tissues. He has since published the results which he obtained, in *Gailliard's Medical Journal*, April, 1880. It at once occurred to me while talking with him on the subject, that the same method might be employed for the detection of such foreign bodies in the eye. To determine the value of the method, I have carried on a series of experiments in the laboratory of the New York Ophthalmic and Aural Institute. The principle I employed is not new, as it had already been used in general surgery.

In 1844, Mr. Alfred Suree published in the *Medical Times and Gazette*, part of a lecture delivered at the Aldersgate School of Medicine, on the detection of needles and other steel instruments impacted in the human body. So far as I have been able to find out, this is the first publication on the subject, and it may be added that all of the rest are based upon his conclusions. He employed a suspended magnetic needle held over or near the suspected part, but the indications thus obtained being insufficient, he suggested that the piece of enclosed steel should be rendered

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a magnet, and then not only its presence but its position and general direction may be made out; and by the amount of magnetism it evinces, its probable bulk may be inferred. To render the enclosed particle magnetic he suggested two methods. First, by transmitting a galvanic current through the suspected part; second, by bringing an electro or permanent magnet near it. This being done, the presence of the magnet in the body was tested for by a minute suspended magnetized needle. The next publication on the subject is by Mr. James H. Aveling, of Aberdeen, in the *Lancet*, 1851, vol. i, p. 149. He proposes a similar test, but makes no reference to the importance of making the enclosed body magnetic, nor does he refer to Mr. Suree's paper. There is a paper "On the magnetic indications of the presence of iron bodies in the tissues," by Dr. Bruce Jones, in the proceedings of the Medico-Chirurgical Society, vol. i, p. 71. This is but a repetition of the suggestions made by Mr. Suree, and the summary of conclusions at which he arrives, may all be deduced from Mr. Suree's article. My brother's article already referred to, "Needles, pins, etc., in the tissues of the body," details several experiments made upon the cadaver to determine the value of the method, and is the only other publication of the kind that I have been able to find. From his experiments he concludes that in the magnetic test, properly applied, we have a certain and available means of diagnosing the presence of needles buried in the flesh, even when imbedded at considerable depth.

The following experiments were made to determine, first, whether unmagnetized particles of iron or steel will exert sufficient influence on a magnetic needle, to indicate with certainty their presence at distances sufficient to make such method available for their detection in the eye. Second, to determine the practicability of rendering such particles magnetic at such distances, as to be able to take advantage of their increased effect on the magnetic needle, for the detection of their presence and location in the eye. These questions may be best answered by referring to the subjoined table:

The first four columns of the table explain themselves. The columns marked *a*, *b*, *c*, give the distance at which deflection of the needle took place—*a*, while unmagnetized; *b*, when rendered magnetic by induction; *c*, after contact with a magnet. The column *d* gives the distances through which the induction took place.

A magnetic needle of 41 *mm.* in length was suspended over a scale; the pieces, of various kinds and sizes, as shown in the table, were brought near it, and the distances noted at which there was caused a marked deflection. These pieces varied in weight from .004 grm. to .136 grm., and caused deflection while unmagnetic at distances varying from 3 *mm.* to 12 *mm.* It is therefore seen that the results must depend largely on the size of the foreign body, but still more on its position in the eye. If, as in the first case, the particle being exceedingly small—smaller, in fact, than is likely to be forced deep into the eye—and its position were deep, the needle would give no indication, while its position, if near the surface, would probably be indicated. If, however, the body were the size of the last in the table, its presence would probably be shown, even if deep in the eye.

The far greater significance and importance of these experiments is shown in that column of the table which answers the second of the propositions. In these experiments a simple bar magnet of 40 *cm.* in length, 4 *cm.* breadth and 6 *mm.* thickness was used, being passed several times over the piece of metal at the distance from it given in the table. In every case except that marked 3, the result was very marked; in number 3, soft iron wire, it was nto possible to render the piece a magnet, even by contact; but, as is well known, such experience would not frequently occur, for very little of the iron in common use is so soft as to make it incapable of becoming a permanent magnet. In cases numbers 4 and 6 it is seen the bar was brought within a distance of 5 *mm.* when the deflecting power of the piece was increased in the one nearly, and in the other to more than, twice that when unmagnetic, and the fact of the particle being now polar giving the double results of repulsion and

attraction. In number 7, where the piece is cast-steel, perhaps the most common of any metal body to penetrate the eye, the result is much more marked, since the deflecting distance was increased from 12 *mm.* to 35 *mm.* The distance between the particle and the magnet was about 1 *mm.* In case 9 the result is still more marked, for the distance here from the magnet was 15 *mm*, while the deflecting power was increased from 10 *mm.* to 30 *mm.* The other experiments are easily understood from the table. In another column will be noticed the effect after contact with the magnet; these results have no bearing on the present subject.

No.	Material.	mm. Le'gth	mm. Br'dth	grm. Wt.	mm. *a.*	mm. *b.*	mm. *c.*	mm. *d.*
1	Watch spring . .	2.	.5	.004	3.	5.	12.	
2	" " . . .	3.	1.	.007	4.	6.	12.	5.
3	Iron wire . . .	1.	1.	.009	4.			
4	Watch spring . .	4.5	1.25	.011	5.	9.	16.	5.
5	" " . . .	4.	2.	.015	5.	12.		6.
6	Steel wire . . .	6.	1.	.039	5.	12.	20.	5.
7	Cast steel . . .	6.	5.	.064	12.	35.		1.
8	Iron wire . . .	12.	1.	.07	7.	15.	30.	15.
9	Watch spring . .	16.	2.	.101	10.	30.	65.	15.
10	Steel wire . . .	9.	1.5	.136	12.	15.		1.

Having in this way ascertained theoretically the applicability of the method for the detection of foreign bodies in the eye, the next step was to make a series of experiments to decide upon the practical value of the method. These experiments, now to be detailed, were conducted on the freshly enucleated eyes of pigs and sheep. Before describing them, however, it may be well to mention the methods employed. In the first six experiments, the suspended magnet employed was an ordinary sewing needle, which had been rendered highly magnetic by contact with a strong horse-shoe magnet and then delicately balanced, suspended

by a fibre of silk and, for convenience of manipulation, attached to the handle of a camel's hair brush or rod. In the next three, a needle, pointed at both ends with the eye in the middle, which was made for me by P. Schmidt, was employed. In all the rest, a needle made by B. Pike's Son, which is described with the first set of experiments, was employed. These several needles were about equally delicate. To render the enclosed bodies magnetic, a horse-shoe and a bar magnet were employed, the latter being the one generally made use of. To accomplish this the magnet was passed over the suspected part several times and in several directions. To avoid any ambiguity in these experiments, proper care was taken to remove the magnets and all steel or iron instruments to a sufficient distance, so that their influence would not affect the needle. Precautions were also taken to use no instruments in the introduction of the steel and iron particles which were themselves magnetic.

Experiment 1, April 10th.

A piece of needle 3 *mm.* in length was thrust through the sclero-corneal margin, from above obliquely downward behind the iris into the vitreous, so that its direction could be seen through the cornea. Its presence and position were then tested for by carrying the suspended magnet around the sclero-corneal margin. There was no deflection until it came to the point of entry of the needle, when it for a moment stood still and then immediately dipped, and became adherent to the tissue, requiring some slight force to draw it away, and when carried on either side of this point the magnet would be strongly deflected toward it. The broken end of the needle was found to be imbedded in the sclerotic, exactly at the spot where the point of the magnet attached itself. In this instance the imbedded needle was not magnetic.

Experiment 2, April 12th.

A piece of watch spring 6 *mm.* long and 3 *mm.* wide was magnetized by contact with a permanent magnet, and on trial deflected the suspended magnet very strongly. A small linear incision was made with a Graefe's knife about 4 *mm.* behind the corneal margin of a pig's eye. The foreign body was introduced

through this opening and pushed toward the centre of the globe, until the outer end disappeared within the lips of the wound. The eyeball was then turned so as to conceal the point of injury, and placed on the table with the pupil looking directly upward. The suspended needle was then carried around the equatorial region and showed a slight deflection on one side, but very marked deflection on the opposite side, attracting the end of the needle, on repeated trials, always to the same point, which, on close inspection, proved to be almost exactly over the incision. On extending the meridional section over half the cornea, at the same time dividing the lens which escaped from the wound, and through the place where the foreign body was introduced, it came out spontaneously. For the sake of comparison, another eye was placed in a similar position near the first, and trials, made in a similar manner, showed no deflection, neither did the eye from which the foreign body had been removed now give any deflection.

Experiment 3, April 12th.

A cystotome was introduced in the equatorial region and pushed straight across the globe, so as to impinge against the opposite wall. The cystotome was previously tested, and found not to be magnetic. The magnetic needle was then passed around the side, where the point of the cystotome was in contact, and the needle was distinctly attracted to the point of the instrument. The instrument was then withdrawn about 4 *mm.*, when the deflection of the needle ceased. Then the direction of the cystotome was changed so as to bring its point against other parts of the opposite wall, and the needle would always indicate the point of contact, the experimenter not being aware of its direction. On testing again after the experiments the cystotome was still found to be non-magnetic.

Experiment 4, April 12th.

This experiment was a repetition of the last, except that a horseshoe magnet was passed near, though not in contact with, the sclerotic at the place where the point of the cystotome rested. The needle was now strongly deflected, and when brought opposite the point of the instrument, was attracted to it through a distance of 4 to 6 *mm.* When it was withdrawn into the vitreous, so as to remove its point 4 to 6 *mm.* from the sclerotic, the needle still showed the strongest deflection at the point where

the cystotome was nearest the sclerotic. But when the point was in the centre of the globe, as could be seen on looking through the cornea, the needle was always deflected when brought opposite this point; but did not attach itself to the tissue, even when held within 2 *mm.* of the sclerotic. When the cystotome was pushed against any part of the sclerotic and moved along it, the needle would always indicate the direction of its point. The instrument was now magnetized so that it would lift a piece of steel of the size used in experiment 1.

Experiment 5, April 14th.

A small piece of unmagnetized watch spring 2 *mm.* square was introduced from above, through the sclero-corneal margin into the anterior chamber of an eye, in which the cornea was opaque, and then tested for with the suspended magnet, by carrying it around the margin of the cornea. No very exact indications were given of the situation of the foreign body, although sufficient evidence of its presence was given. After being magnetized *in situ*, by bringing a bar magnet over the cornea, the needle was deflected so as to precisely indicate the situation of the foreign body, on the floor of the anterior chamber. In opening the eye at this place, the foreign body was found 2 *mm.* to the side of the incision. The incision was made with difficulty because of the thickness of the cornea and softness of the globe. It is possible, therefore, that the position of the foreign body may have been changed in its execution.

Experiment 6, April 14th.

A piece of steel 6 *mm.* long and 2 *mm.* wide was introduced through a linear wound, about 2 *mm.* behind the sclero-corneal margin, and carried obliquely downward and backward as far as possible into the vitreous. This was done by one experimenter while the other was absent from the room. The globe was then placed on the table with the cornea directed upward. No trace of the wound, through which the body had been entered, could be seen without close inspection. Testing with the suspended magnet showed a point where the needle was strongly deflected, and where, after swinging from one side to the other, the point finally attached. This point being carefully noted, an incision with Graefe's knife was made, and the foreign body found exactly at the spot indicated, which proved to be about 4 *mm.*

downward and to the side of the incision through which it had been introduced. In this case the foreign body was rendered magnetic as in the previous experiment.

Experiment 7, April 29th.

A piece of cast iron about 2 *mm.* long and 1 *mm.* wide, cut from the end of a brad, was introduced through a small flap wound at the equator and pushed as far as possible into the vitreous. An attempt was then made to grasp it by passing in a small pair of forceps, but did not succeed. Care was taken to prove that the forceps were not magnetic. After carefully readjusting the small scleral flap, the eyeball was placed in the same position as before mentioned. The foreign body was rendered magnetic with the bar magnet as before. Its presence and position were now tested for by an assistant who had not seen it introduced and could not now see the incision. A point was readily found where the needle always pointed, and when carried to one or the other side of which, it attempted to turn back, and when held opposite it, swung to and fro with a decided tendency to become attached to this point. Upon making an opening here, which was 1 *mm.* from the place where the foreign body was introduced, and obliquely downward and outward, it was found between the choroid and retina.

Experiment 8, April 29th.

This experiment was of a similar character to the preceding one, except that the small scleral flap was placed nearer the corneal margin. The body introduced was of similar material, 2 *mm.* long, but not so thick. It was tested for by another experimenter first before being rendered magnetic, when but slight indications were found. After passing the bar magnet along the sclerotic, without, however, touching it, the plane of the magnet being tangent to the equator, the foreign body was again tested for. The needle now showed decided deflection at one point, which deflection was constant. The vibrations became shorter and more definite, and there was a tendency for the point to come in contact with the eye. The foreign body was now sought for by extending the flap through which it was introduced in a vertical direction, and making another incision to meet it at right angles. This flap was then dissected backward, and the foreign body found where indicated by the needle, 1 *mm.* from its point of insertion,

in a direction obliquely upward, about 4 *mm.* from the sclero-corneal margin. It was in the flap between the sclerotic and choroid. Upon examining both these bodies after their removal from the eye, they were found to be slightly magnetic.

Experiment 9, April 29th.

A piece of watch-spring 2 *mm.* long and 1 *mm.* wide was introduced about 2 *mm.* behind the upper sclero-corneal margin, and then pushed as far as possible into the vitreous. After rendering it magnetic as usual, it was tested for while the eye was lying with the cornea looking upward. The needle indicated its position about 6 *mm.* below the point of introduction, but on making the exploratory incision at this place, the foreign body was not found. The needle was again put into requisition, but no indications of its presence were found in this locality. It was not until the posterior part of the globe was turned upward that any other indications of its position were obtained, and now a point was found near the optic nerve where the needle was markedly deflected. Upon making an equatorial section of the globe, the foreign body was found in the vitreous, with one end of it partly covering the papilla, and the other lying on the retina, it having passed obliquely downward and inward through the vitreous.

Experiment 10, May 6th.

In order to render the introduction of the foreign body into the vitreous more certain, the following device was resorted to in the next two experiments. A small linear piece of watch spring 4 *mm.* long and 2 *mm.* wide was tied to a piece of fine silk, the thread passing in the direction of its length, the other end being threaded through a needle. The latter being carried obliquely through the eyeball, emerged at the equator. When the body came in contact with the opening in the sclerotic, this was enlarged so as to admit of its entrance into the eye. The foreign body was drawn some depth into the vitreous and the thread cut off. After the entrance of the foreign body, neither the wound of entrance nor that of exit thus made could be seen. The eye was placed on the table, cornea upward, and the presence and position of the foreign body tested for by carrying the needle around the globe. A point was found about 6 *mm.* below the sclero-corneal margin, where the needle was distinctly though not strongly deflected. An iridectomy knife was entered at this point and at-

tempts made to seize and remove the foreign body, which, although we thought we could feel it with the forceps, were not successful. This wound was now made into a flap by carrying an incision at right angles to it, and when the flap was reflected, the course of thread through the vitreous could be seen by oblique illumination. Following it as a guide, the foreign body was found in the vitreous 3 or 4 *mm.* from the walls of the eye, and almost exactly opposite the point which had been indicated by the needle.

Experiment 11, May 5th.

The eye end of a needle 6 *mm.* in length, through which a thread had been passed, was threaded on another needle. The latter was carried directly through the centre of the cornea and made to emerge near the optic nerve. When the broken piece of needle was drawn to the corneal wound it was with great difficulty made to enter the eye, necessitating enlargement of the wound. It was then drawn through the lens into the vitreous chamber and the thread cut off. Search was then made in the usual way; first without magnetizing and without results. Then the foreign body was magnetized in the manner explained, and placed on its side with the cornea toward the operator. The point of the needle was attracted toward the point in the cornea where the foreign body had been introduced, but so feebly as to suggest that it had been carried to a considerable depth in the eye. Upon searching at the opposite pole the indications were about the same, or perhaps less decided. The globe was opened by a meridional section and the broken needle found in the vitreous, lying almost exactly in the antero-posterior axis of the eye.

Experiment 12, May 15th.

A piece of steel wire 4 *mm.* long was introduced, about 3 o'clock P. M., into the vitreous chamber of a healthy rabbit. This was effected by plunging a small trochar and canula into the vitreous just behind the sclero-corneal margin, withdrawing the trochar and pushing the wire through the canula. The canula was then removed with little or no loss of vitreous, and the wound closed by a conjunctival suture. About 8.30 o'clock, P. M. the same day, the eye was examined and found in a state of high inflammation. There was a good deal of chemosis, dullness of the iris, moderately dilated pupil, with a yellowish-white reflex from the vitreous

(purulent choroiditis). The presence or position of the foreign body was not to be made out by oblique illumination. The animal having been put under the influence of ether as before, the eyeball was extended as far as possible from the orbit by introducing underneath the lids small Desmarre's elevators. The location of the foreign body was now sought for with the suspended needle by carrying it around the eyeball, which could be readily extended as far as the equator. Now an indication as to its location was afforded by the deflection of the needle about 5 *mm.* behind the point of its introduction near the equator of the eye. There were no indications elsewhere. This indication, which was not very decided, became exact after magnetizing the foreign body. Most unfortunately, just as the incision to accomplish the removal of the foreign body was made, the rabbit died from the effects of the ether. The precise locality of the foreign body was now determined by reflecting a scleral flap, when it, surrounded by a mass of exudation, was found, corresponding with great nicety to the place determined by the magnet. So precise was the indication of the site of the foreign body that it might have been removed, although the exudation in which it was imbedded would have rendered this extremely difficult.

Experiment 13, May 15th.

A foreign body of the same material and about the same size as that used in the last experiment was introduced in the same location, but by another method. An exploring needle was thrust through the coats of the eye and attempts made to push the foreign body along its groove into the eye, but without success. The incision was then slightly enlarged by a Graefe's knife, and after several unsuccessful efforts, the foreign body always being forced back, it at last disappeared in the vitreous, and the wound was hastily closed by a conjunctival suture. In the evening of the same day, and at the same time as in the other case, the eye was examined and showed the same condition, but to a less marked degree than in the other rabbit. The opacity of the vitreous, however, was not so great as to entirely shut off the reflex from the fundus. It was not, however, possible to determine either by oblique illumination or by the ophthalmoscope the position of the body. About 8 o'clock, P.M., the rabbit being placed fully under the influence of ether, search was made for the foreign body in the same manner as

described in the other case. The indications given by the needle located the foreign body about 2 to 3 *mm.* to the nasal side and toward the equator of the eye. The suture was removed, the wound enlarged in the supposed direction of the foreign body, and then attempts made to remove it with a magnet. Neither Hirschberg's electro-magnet nor the permanent one described by Gruening being at hand, one was improvised for the purpose. This was done by fastening a piece of steel wire about 35 *mm.* long and 1 *mm.* in diameter to the bar magnet by an elastic rubber band. The point was bent at about the same angle as the hook devised by Dr. Knapp for the removal of foreign bodies from the vitreous. The point being tested, it was found to be powerfully magnetic, quite as much if not more so than those above referred to. This instrument was then carefully carried about in the supposed direction of the foreign body, but after repeated trials failed to remove it. Its removal was now attempted by making a small flap so as to include in it the suspected locality. When this flap was reflected and light thrown in by oblique illumination, the foreign body could be seen enveloped by a mass of exudation, from which it was removed with forceps only after considerable difficulty. This mass of exudation extended from the wound in the direction of the foreign body. Upon cutting into the eye with the escape of vitreous a reddish fluid flowed out, this discoloration doubtless being caused by hemorrhage, which had diffused itself through the vitreous. The globe, which was now somewhat collapsed by loss of vitreous, was closed by replacing the flap and stitching it in position. The acute symptoms rapidly subsided, but the eye became phthisical in the course of the next four days.

Experiment 14, May 19th.

At 3 o'clock P.M., a piece of wire of the kind already mentioned, and about 3 *mm.* in length, was introduced into the other eye of the second rabbit, through a much smaller canula than the one employed in the first of these experiments. The opening made above, and 3 or 4 *mm.* behind, the sclero-corneal margin, the canula was carried through the vitreous nearly to the opposite wall; the foreign body could be distinctly seen in the vitreous when pushed from the canula. On withdrawing the canula, the wound was closed by suture without the loss of any vitreous. When the eye was examined about 9 o'clock P.M., the same day, there was but little reaction, no swelling of the lids or chemosis.

The ophthalmoscope showed some diffuse opacity of the vitreous, but the eye could still be faintly illuminated both by oblique and ophthalmoscopic examination. A line of opacity could be traced from the wound, running obliquely downward and somewhat inward. At its termination the foreign body could be seen apparently lying upon the retina. The eye underwent very little change, except that the vitreous became more opaque, and by 3 o'clock the following afternoon the position of the foreign body could no longer be made out. The rabbit being etherized, the position of the foreign body was examined for by the magnetic needle after having been magnetized. Upon bringing the needle near the point diametrically opposite, it began to give evidence of the presence of a foreign body; but when the needle was carried 2 or 3 *mm.* to the nasal side of this point, the indications were much more accurate, and the needle was attracted so strongly as to become attached to the tissue. An incision was made in the place thus indicated, and the removal of the foreign body attempted by a bent wire and forceps. After repeated attempts the foreign body was at last grasped by a pair of small anatomical forceps and removed. No attempts were made to see what influence its removal would have, but the globe was opened and the condition of the vitreous more fully examined. The same exudative mass was seen in the vicinity of the foreign body, and from the wound streaks of pus radiated through the vitreous.

From the general review of these experiments it follows with great uniformity that, as the result of the examinations, indications of both the presence and locality of the foreign bodies were obtained in all of them. The value of these indications varies, however, in different instances.

In experiment 1, in which one end of the foreign body was purposely left imbedded in the sclerotic, it showed its presence even when unmagnetized, and the indications were here so precise that the removal of the foreign body was very easy. This would seem to show that, in such instances, the method will be of great service in determining the precise place to make the incision for its removal, when one end of the body is left in the tissue.

In experiment 2, where the foreign body was magnetized before its introduction into the eye, the indications of its presence and position were very strongly marked, making

it easy to exactly locate the foreign body, especially as it was near the point at which it had been entered. Of course the very clear indications given in this case were attributable to the body being much more powerfully magnetic than if it had been rendered so when in the eye.

Experiments 3 and 4 were exceedingly instructive by showing in a very striking manner the relative value of the behavior of the needle before and after the cystotome was rendered magnetic. In the first instance, its point could only be detected by the needle when in contact with the walls of the eye; but when it had been rendered itself a magnet by induction through the walls of the eye, its point could be readily detected, even when 4 to 6 *mm.* distant from the sclerotic. The deflection of the needle, by the force with which it was attracted to the sclerotic (when the foreign body was magnetized) gave evidence of its depth in the vitreous. It is also of value to observe how every change in the position of the instrument was shown by the strongest deflection of the needle, whereas, when the point lay in the centre of the vitreous, the needle was only slightly deflected when brought in any direction which corresponded to the point. The conduct of the suspended magnet with reference to the point of the instrument, could be obtained by looking into the eye, thus affording valuable evidence of the significance of the experiment.

Experiment 5 was purposely made upon an eye in which the cornea had become opaque by being kept in Müller's fluid, in order to obtain information as to the precision of the method when the foreign body lay in the anterior chamber. It will be seen although the particle was very small (only 2 *mm.* square), and gave before magnetizing it no exact indications, when it had been rendered so, the indications were much enhanced. It is true that foreign substances in this position can usually be seen by oblique illumination, but in the event of their presence being concealed, or rendered doubtful by hemorrhage, exudation, or opacity of the cornea, the additional evidence of their presence and position thus afforded would be of great assistance.

In the next three experiments (6, 7 and 8) the indications

of the position of the foreign body were beautifully shown, and it may fairly be claimed that in every instance with such an accurate guide as to the position, they might have been removed in the living subject.

Experiment 9 is particularly instructive, because of the failure to find the foreign body in the situation where it was located by the magnet. It is highly probable that its position was changed by the incision which was made to disclose its whereabouts, for when the indications were sought again in this place they were no longer to be found. It was not until the globe was tested upon its posterior pole that its presence again became manifested, and there they exactly defined its position.

Experiments 10 and 11 were conducted in such a manner as to carry the foreign bodies with more certainty into the depth of the vitreous chamber. In only one of the preceding ones, that just before mentioned, did this succeed, and then probably only while attempting its removal. It will be found very difficult to accomplish the introduction of a foreign body any considerable depth in the vitreous chamber by introducing it through incisions or flaps. The manner in which this was accomplished is detailed in the experiments. In the first of these experiments the indications given by the needle of the position of the foreign body was proven to be very exact, although it was situated 3 or 4 *mm.* from the walls of the eye. In the other case where the foreign body had been introduced along the antero-posterior diameter of the globe, the indications were found only at the anterior and posterior poles, but very feeble. From these facts may be deduced the position in which it lay, *i.e.*, its location exactly in the centre, which proved to be the case.

The experiments which were more exactly germane to the application of the method to practical ophthalmology, however, were the last three conducted upon living rabbits. In all of them very precise information as to the position of the foreign body was given, and in two the pieces of steel removed. In the first of these it would have been easy to remove it, as shown by the examination

after the animal died. In all of these experiments the position of the foreign body was not to be made out by the usual means of examination, although it could be seen some time before in the first case.

I wish to call attention, although somewhat foreign to the purpose of these experiments, to the enveloping of the foreign body in a dense exudation, which was noticed in all three of these experiments. Pagenstecher calls attention to the same condition in *Archives of Opthalmology and Otology*, vol. 1, p. 535. It is possible that the very rapid manner in which the eyes of these animals take on purulent inflammation, causes this condition. The practical value of the fact is that it renders the removal of the foreign body very difficult, and almost precludes the possibility of accomplishing it by the use of a magnet. In one instance I tried to draw the foreign body through this exudation with a powerful magnet, but could not accomplish it.

I think we may draw the following conclusions from these experiments:

1st.—*The presence of a steel or iron foreign body in the eye, when of considerable size and situated near the surface, may be determined by testing for it with a suspended magnet.*

2nd.—*The presence and position of such a foreign body may most surely be made out by rendering it a magnet by induction, and then testing for it by a minute suspended magnet.*

3d.—*The probable depth of the enclosed foreign body may be inferred by the intensity of the action of the needle near the surface.*

4th.—*Any change from the primary position of the foreign body may be ascertained by carefully noting the changes indicated by the deflection of the needle.*

It is not my purpose to claim more for this method than the facts sustain. Among other precautions in the conduction of my experiments, I have tried not to be magnetized myself by my interest in the subject. Much may yet be done to perfect the method. It seems to me es-

pecially desirable that a more delicate needle than I have yet been able to obtain should be made use of. It is not too much to say that my studies of the method lead me to predict a useful future for it in practical ophthalmology.

In conclusion I desire to return my sincere thanks to my friend, Dr. Arthur B. Townsend, for his very valuable assistance and useful suggestions in conducting these experiments, without which I could not have carried them to a successful conclusion.

A CASE OF CYSTICERCUS INTRA-OCULARIS.

REPORTED BY E. VOGLER, M. D.,

ASSISTANT AT DR. HIRSCHBERG'S OPHTHALMIC CLINIC.

Translated by ISIDOR FURST, of New York.

(*With one wood-cut.*)

M. K., a girl of 12, was admitted on March 10, 1879. The left eye is sound; the right has been blind for four months, and inflamed three days. The picture is that of amaurotic cat's eye: a brass-yellow reflex from the pupil. There exists, besides, pericorneal injection, some posterior synechiæ; lens transparent; in the neoplastic mass within the vitreous no circumscribed tumor-like elevations, but some blood-streaks are visible. Tension normal.

The diagnosis was necessarily somewhat doubtful. An ordinary product of inflammation had to be excluded. No lesion was discoverable. Cysticercus was at once thought of, but no certainty could be obtained from the anamnesis. Glioma was improbable; leucosarcoma of the choroid, however, was possible.

Enucleation was performed on April 11th, and patient discharged a week later.

After about one week's hardening in Müller's fluid, the globe was bisected in the horizontal meridian. (See Fig. 1, *A* and *B*.)

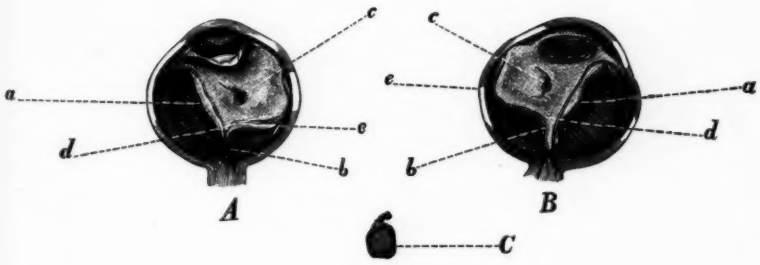
A, inferior, *B*, superior half of the globe. The other letters apply to both halves. In *A*, the one half of the lens is missing, and we see only the pigment layers of the iris, together with remains of the suspensory ligament of the lens. In the same section, too, the separation of the optic nerve from the retinal funnel is artificial.

A funnel-shaped detachment of the retina exists (*a a*). The stem of the funnel is connected with the optic nerve (*b b*). In the centre of the solid funnel the section has opened the root of

a smooth-walled cavity (*c c*); within the cavity lies a cysticercus cellulosæ with expanded head, 8 *mm.* in diameter (see A, *c* and C). The cavity is situated in the yellowish vitreous (*d d*), which shows a connective-tissue condensation; the thickened retina forms a grayish mantle to the funnel. On one side, in the equatorial region, the funnel adheres to the choroid which at that place is infiltrated with blood and dragged away from the sclerotic (*e e*). Cyclitis clearly marked.

The specimen was intrusted to Prof. O. Becker.

The above sketch of our case is justified by the relative scarcity of cases of intra-ocular cysticercus which have thus far received an anatomical examination against the proportionately large number of patients * in whom the presence of the parasite was positively demonstrated by the ophthalmoscope, barring the cases in which only a probable diagnosis could be formed on account of



opacity of the media. Some interest, too, might attach to it because the parasite had its seat nearly in the centre of the vitreous, while in the cases hitherto published of anatomical dissections it was found mostly behind the retina (subretinal); or, if situated in the vitreous, immediately in front of the retina (præretinal).

The following authors, as far as I know, have thus far furnished anatomical descriptions of intra-ocular cysticerci.

1. ALFRED V. GRÄFE'S case (*Zehender's Klin. Monatsbl. f. Augenhlkde.*, 1863) related to a cysticercus which occupied a cyst (in

* In Berlin and Northern Germany, cysticercus cellulosæ seems to occur disproportionately more frequently than in other regions. A. v. Gräfe, among 80,000 patients, had 80 suffering from cysticercus intrao-cularis, that is, 1 : 1,000. Hirschberg, in the first eight months of 1874, among 2,100 new patients, had 5 cases, or 1 : 420. Likewise in succeeding years, *e. g.*, in the first five months of 1875, four among 1,800 patients.

the detached retina which was in a state of fibrous degeneration).

2. SOELBERG-WELLS (with Bader: *Ophth. Hosp. Rep.*, vol. iii, p. 324), case of *subretinal* cysticercus.

3. A. v. GRÄFE and SCHWEIGGER (*Arch. f. Ophth.*, Bd. vii, 2, p. 53). In this case the worm was also *subretinal.*

4. JACOBSON [with von Recklinghausen (*Arch. f. Ophth.*, Bd. xi, 1, p. 147)] describes two cases of intra-ocular cysticercus:

a. In the first the worm was *behind* the retina.

b. In the second case the vitreous space was occupied by a dense whitish tissue, in which was a cavity the size of a pea, containing a headless cysticercus.

5. HIRSCHBERG (Virchow's *Arch. f. Pathol. Anat. u. Physiol. u. f. Klin. Med.*, Bd. xiv) gives the anatomical description of a *subretinal* cysticercus in an eye enucleated by A. v. Gräfe. The worm was one of the largest so far observed in the human eye.

6. By the same author (*Arch. f. Ophth.*, Bd. xxii, Abth. iv, pp. 126–130) two cases of *subretinal* cysticercus.

a. The first case was of about the earliest stage of the parasite.*

b. Of the second case the preparation was sent to Prof. Becker, who, in his "Atlas of the Pathological Topography of the Eye,"† besides a magnificent drawing, gave a full description of the macroscopical and microscopical conditions.

7. JACOBSON (*Arch. f. Ophth.*, Bd. xi, 2, p. 162) found a cysticercus rather unexpectedly in the anatomical examination of a phthisical globe.

8. HIRSCHBERG's case (*Archives of Ophthalmology and Otology*, vol. i, p. 630) was *subretinal.*

9. O. BECKER (*Atlas der Pathologischen Topographie des Auges* Bd. iii, 1878) gives there, besides the eye with subretinal cysticercus enucleated by Hirschberg, the description and representation of a globe enucleated by himself. The worm was situated in the *vitreous*, immediately in front of the retina.

10. SÄMISCH (*Kl. Monatsblätter f. Augenheilkunde*, Bd. viii, pp. 170–173) gives the post-mortem description of an eye with *subretinal* cysticercus.

11. M. PONCET (*Gazette médicale de Paris*, No. 10). Case of *subretinal* cysticercus in a French soldier who had been a captive in Germany.

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* Comp. Ewer's 2d Jahresbericht, pp. 7–11.

† Third number, Vienna, 1878. Wilhelm Braumüller.

12. IHLO, R. A case of cysticercus cellulosæ *subretinalis*, (*Inaug. Dissert.*, Leipsic).

13 and 14. O. BECKER has also edited an additional photographic representation of an eye enucleated by Hirschberg, in which the worm was situated *immediately in front of the retina*. A detailed anatomical description of this case has not appeared at this time. A case of Hirschberg's will probably be mentioned in the next number of the *Ophth. Hosp. Reports*.

A REMARKABLE CASE OF DETACHMENT OF THE RETINA, WITH HEMORRHAGE INTO THE VITREOUS, SIMULATING INTRA-OCULAR TUMOR.

By DAVID WEBSTER, M.D., New York.

The patient, a maiden lady, aged 27, about June 1, 1876, became conscious of some trouble with her vision. She closed one eye and then the other, and so discovered that her right eye was almost blind. There were no premonitory symptoms, no accompanying pain, photopsiæ or chromopsiæ. What little remained of sight gradually disappeared, and when I first saw the lady on the 11th of the following August, there remained no perception of light. There was not then, nor had there been, any redness or other external symptom. Examined with the ophthalmoscope, the pupil dilated by atropine, the reflex was totally black, except a small reddish area at the lower border of the lens and extending up behind it to the extent of about a millimetre. Oblique illumination showed the same appearances. The tension was about normal.

The eye was kept under observation until January 24, 1877, a period of a little over five months, during which no change occurred, except that the reddish area gradually crept up behind the lens until it covered the lower half of its posterior surface, and gradually increasing pressure in the vitreous chamber so caused the lens and iris to advance, that the anterior chamber became very shallow. The patient was seen in consultation by Drs. Roosa, Pomeroy, Agnew, and others, but none of us were able to make a positive diagnosis; all agreeing that we had to do with either a case of intra-ocular *hemorrhage*, with detachment of the retina, or a case of intra-ocular *tumor*, with detachment of the

retina, and all agreeing that it would be the part of prudence to enucleate the eye. This was accordingly done, and the eye placed in Müller's fluid.

Dr. E. A. Maxwell, who, at the proper time, examined it macroscopically and microscopically, has made the following report:

Macroscopic Examination.

External appearances normal. Section made in horizontal meridian. Measurements in antero-posterior and transverse diameters, each seven-eighths of an inch. Retina completely detached. Crystalline lens pushed forward, almost obliterating anterior chamber, the remains of which are only about one line in diameter. The vitreous chamber is occupied by a conical blood clot, extending from the posterior surface of the lens to the back part of the eye. At the equator the clot measures five-eighths of an inch, leaving one-eighth of an inch space on either side for altered vitreous. The clot is covered on its outer surface by the detached retina. It is apparently composed of two portions, the older coagulum, partially decolorized and stratified, occupying the outer and posterior portions of the clot, while the central and anterior portions are dark and soft. The appearances of the stratification of the clot, and the more recent hemorrhage, point to the vicinity of the ciliary region as the seat of hemorrhage.

Microscopic Examination.

Sclera, optic nerve, cornea and lens show nothing of note. The *choroid*, excepting the lacerations of its internal layers, and its hyperæmic blood-vessels, appears comparatively normal. The *retina* may be said to be almost completely disorganized. Its ultimate structure is scarcely recognizable. It is thickly infiltrated with myriads of small round lymphoid or inflammatory cells, a few wandering or pigmented cells from the choroid, and contains numerous small hemorrhages. Its external surface has portions of the internal layer of the choroid adherent to it, and to its inner surface the blood clot is adherent. This condition is general, but

most marked anterior to the equator. The remains of the vitreous contains disseminated blood corpuscles. The *ciliary* body shows markedly hyperæmic blood-vessels, occasional small hemorrhages, and numerous inflammatory cells in the interstitial tissue. The iris, except its ciliary border, seems normal.

OPHTHALMIC MISCELLANIES.

By F. C. HOTZ, M.D., of Chicago.

1. *A small fragment of steel enters the eyeball near the margin of the cornea, and passes out near the optic nerve.*

On August 26, 1873, Mr. August K., aged 27 years, was working in a machine shop, when a small chip broke off from the cutting edge of his chisel and flew into his left eye. He felt a stinging pain only for one instant, then he could see again as well as before. But the thought that the foreign body might possibly have entered the eyeball, worried him so much, that at once he repaired to an oculist, who, after ascertaining that the steel chip passed through the cornea into the interior of the globe, urged the immediate removal of the eye. This proposition did not seem acceptable to Mr. K., unless it should be concurred in by another oculist. For this reason, he called on the following day, to have my opinion.

I found the eye free from pain; a very slight pericorneal redness; a clear cornea and anterior chamber, and a pupil fully and regularly dilated by atropine; $V=\frac{20}{10}$, and Tn. After some search I discovered a minute, linear scar, scarcely 1 *mm.* in length, at the nasal end of the horizontal meridian of the cornea close to the sclero-corneal border, and opposite that point the periphery of the iris was perforated; for when the eye was illuminated by means of the ophthalmoscope, the red glow of the fundus could be seen there through a small oval aperture. I further ascertained with the ophthalmoscope, that the texture and transparency of the crystalline lens were not disturbed, but a narrow opaque stripe with fringed edges ran horizontally through the vitreous body. Backward this striped opacity could be traced to a point of the fundus, which was a little external to, and about one

diameter of the papilla below, the optic disc. From this point forward, the opacity, gradually increasing a little in width, could be followed up, behind the transparent lens, to the vicinity of the button-hole in the iris; but I could not see its direct connection with the perforation on account of its extremely peripheric situation. This opacity resembled very much the fissures or cracks in a block of ice through which a small solid body has passed with great velocity; and undoubtedly it represented the track left by the fragment of steel in its passage through the vitreous jelly. Where this track terminated at the fundus, the sclerotic was exposed through a rent of the retina and the choroid, and in the centre of this traumatic coloboma there was a slit-like purplish spot surrounded by little blood dots. As the most searching scrutiny of the vitreous chamber could not find the foreign body, I came to the conclusion that it struck the fundus with sufficient force to cut its way through the tunics of the globe. Under a protective bandage and the use of atropine the vitreous cleared up; the hemorrhagic spots upon the retino-choroidal coloboma disappeared, and in its centre I could distinctly see a linear scar; $V=\frac{20}{30}$. The patient being a skilled draftsman, could easily sketch upon paper the outlines of the scotoma which he observed above the point of fixation, and which was the exact, enlarged and inverted image of the coloboma.

I regret it exceedingly that I lost sight of the patient after September 7, 1873. I hoped he would turn up some day that I could ascertain whether the eye remained as good as it was then, and especially whether or not the lens underwent any changes. If the steel wounded the periphery of the lens, the presumption is that it became cataractous in the course of time. But could the minute fragment not have entered the vitreous chamber through the zonula Zinnii without touching the lens? If I draw upon the horizontal section of the eyeball (as represented upon page 43, vol. i, of the Handbuch von Graefe und Sæmisch) a straight line from the junction of the inner margin of the cornea with the sclero-corneal border through the zonula to the fundus, it reaches the latter just a little externally to the optic disc, and such a line would mark exactly the direction the steel took from the point of its entrance to that of its exit from the eyeball.

2. *Rheumatic irido-choroiditis with gelatinous (spongy) exudation, the right eye being affected five months later than the left.*

Mr. C. A. R., æt. 22 years, son of scrofulous parents, and himself exceedingly scrofulous, was repeatedly laid up with articular rheumatism. Four years ago both knee joints were swollen very badly, and for many months he was obliged to walk on crutches. Ever since that time the right knee was so sensitive that it became swollen and tender upon the slightest provocation. No syphilitic taint. The patient's mother and sister were afflicted with trachoma, and he himself had been under treatment for the same malady the past eight months. The corneæ were not involved until quite recently. One week ago, for the first time, an ulcer of the left cornea was ushered in by violent pain and very marked symptoms of irritation. Although atropine was used at once, the pain became more severe, and a violent iritis supervened. The day before yesterday six leeches were applied to the left temple and calomel was freely given internally, whereupon the neurosis abated, but the sight became exceedingly poor.

This was the information I received from the attending physician, who called me in consultation on April 4, 1878. My examination revealed the following state of the *L. E.*: Slight œdema and ptosis of the upper lid; profuse secretion of tears; redness and swelling of tarsal and retrotarsal conjunctiva, and a dense vascular zone round the cornea. The whole surface of the cornea was dull, and in its lower temporal section there was a grayish white opacity, but no ulceration. The aqueous humor was clear, the iris very hyperæmic, greenish yellow (right iris being light blue). The pupil was moderately dilated, but filled with a gray, gelatinous substance which had a smooth, globular surface, and projected a good deal into the aqueous humor. In the level of the iris it was indented, but seemed to spread out again behind the iris, its shape being like that of a shirt stud; it seemed as if a portion of the lens, swelling within its capsule, had been crowded through the pupil into the anterior chamber. T + ?; V = quantitative perception of light; ciliary region not particularly sensitive upon pressure. The treatment with atropine (locally) and calomel (internally) was continued.

April 6th.—There was less pericorneal redness, and less hyperæmia of the iris, and the exudation in the pupil had contracted

so much that, at its nasal side, a crescent of black pupil appeared. Tn.; V= counting fingers at one foot. Marked mercurialization, therefore calomel discontinued.

April 7th.—Pupil better dilated than heretofore. The edge of the gelatinous cake was detached from the capsule of the lens and rolled up upon itself. During the night patient was seized with fever, and pain and swelling of the right knee-joint. Ordered sod. salicyl. 0.50 every three hours.

April 10th.—Gelatinous exudation reduced to a few small spots upon the lens capsule. The salicylate of soda had to be stopped on account of severe irritation of the bladder.

April 21st.—All traces of the gelatinous deposit had disappeared; but though cornea and lens were perfectly transparent, patient could count fingers at four feet only. *Further examination found diffuse cloudiness of the vitreous and T—.* Atropine was discontinued, and calomel (0.025) given three times daily.

May 3d.—Vitreous body was sufficiently clear to permit of an inspection of the fundus, which showed nothing abnormal. Tn.; V $\frac{20}{100}$. A great many enlarged follicles in the retrotarsal conjunctiva.

Patient left the city for his home in Indiana, with instructions for the treatment of the follicular conjunctivitis. In July he returned with a violent fascicular keratitis of the right eye, which was speedily cured by ung. flavum. The left eye was very well, with V. = $\frac{20}{30}$.

On September 10th the patient came back again with an acute exacerbation of follicular conjunctivitis in the *right* eye, complicated by multiple phlyctænular infiltrations in the cornea. The pupil was readily dilated by atropine.

For the past week patient had periodic attacks of neuralgia in the right side of his face; had a very violent attack last night. Ordered quinine 0.05 every hour.

September 14th.—No neuralgia; *pupil dilated, but filled with a bulky, flocculent or woolly substance.*

September 17th.—Exudation contracted to a small triangular, gelatinous cake.

September 20th.—Exudation entirely absorbed.

October 27th.—Patient had a very severe bronchitis the past three weeks. Corneæ of both eyes quite clear. *R. E.* V = $\frac{20}{40}$; slight haziness of vitreous, so that the retinal vessels were indistinct; hyperæmia of optic disk. *L. E.*, V = $\frac{20}{30}$; vitreous per-

fectly clear; optic disk perhaps a shade redder than normal, but well defined.

November 4th.—Each eye, V = $\frac{20}{30}$; clear vitreous and slightly reddened papillæ.

The patient, however, enjoyed the good sight but a very short time, for during December it was impaired by pannus rapidly spreading over the whole corneæ. But from this time on the case has no further interest.

3. *Syphilitic iritis with gelatinous exudation.*

In the beginning of Nov., 1878, the wife of a poor laborer was admitted to the Illinois Charitable Eye and Ear Infirmary. Her face was thickly covered with syphilitic papulæ, which were also plentiful on the integument of the arms and the body. She also had syphilitic pharyngitis, and for nine days an iritis of her right eye. The pupil was contracted, and occluded by a thin film of gray exudation; the iris was discolored and swollen, and contained several small condylomata and a very large one in its lower half. She could just distinguish shadows, and every night she suffered the most violent pain in the right side of the forehead. I prescribed atropine, and for internal use iodide of potassium. For some reason I did not see the patient again until November 12th, when I found a remarkable change in that eye. The pupil was a little larger, but filled with a gelatinous substance which, in size and color, was not unlike a cataractous lens. The lower border of this gelatine-cake overlapped considerably the lower edge of the pupil.

This whole exudation was absorbed in the course of one week, and the pupil was then found occluded by a thin gray membrane, as on the day of admission, only near its upper margin there was just a minute opening through which V was improved so much that she could count fingers at a distance of 10 feet.

4. *Tonic Blepharospasm of five months' duration relieved by one application of tincture of iodine.*

Miss Martha J., æt. 17 years, American, was admitted to the Illinois Charitable Eye and Ear Infirmary on the 9th of March, because for five months she had not been able to open her right eye. Nine years ago she received a severe blow upon the right eyebrow with a piece of wood, and four months later a crumb of

dry bread was thrown at her right eye. Both accidents, however, did not seem to be of any consequence, for the eye continued to be as good and strong as the other until one year ago last fall, when both eyes became very red and painful. The inflammation (which probably was phlyctænular keratitis) was particularly severe in the right eye and lasted three months. Then her eyes were well again until five months ago, when she had "erysipelas of the eyelids;" the lids of the right eye were swollen and red, and when the swelling had disappeared she could not raise the upper lid; and, in spite of various remedies her physician had tried, the right eye remained closed.

The examination revealed a very remarkable tetanic contraction of the supra-orbital portion of the right orbicularis muscle. The eyebrow was drawn down, being considerably lower than that of the left eye; it covered the whole upper lid so that the ciliæ only were visible. The integument of the region of the eyebrow was neither red nor swollen nor tender on pressure, but it was firm like a contracted muscle, and the patient felt an unpleasant soreness in it. Nowhere about the head or neck could I find any "pressure-point." But when the eyebrow was lifted up and held in its natural position by a gentle pressure of the finger against the supra-orbital margin, the patient could at once open her right eye without the least difficulty; the tarsal skin appeared perfectly smooth, there being evidently no spasm of the lid portion of the orbicularis muscle. As soon as the finger was withdrawn from the eyebrow it was drawn down and the eye closed again. Electricity had no effect upon this spasm. The eye was very hypermetropic, showed considerable hyperæmia of the ocular conjunctiva and several superficial opacities in the cornea. Thinking the blepharospasm might, perhaps, have been caused by spasm of accommodation or by irritation of the corneal nerves, I instilled atropine. But the repeated use of the strong ($\frac{1}{8}$ per cent.) solution did not affect the spasm. Before and after atropinization V=$\frac{20}{50}$; H=$\frac{1}{12}$; *L. E.* V=$\frac{20}{50}$; H=$\frac{1}{12}$; cornea normal.

At a loss what further to suggest, I remembered a case of persistent blepharospasm, which Prof. Zehender relieved by the use of tincture of iodine.* And, *ut aliquid fiat*, I pencilled tincture of iodine into the region of the right brow. The effect was like a miracle; after two minutes the muscle was relaxed, the eye-

Klin. Monatsbl. f. Augenheilk., xiii, p. 293.

brow had recovered its natural position, and the patient could open and shut the eye at will. But strange to say, on the following day the right lower lid, which had been perfectly normal, was inverted. It was a spastic entropion which was easily relieved by a slight traction upon the lid. During the day the lid retained its normal position, but became inverted again during the night. On March 16, therefore, I applied the tincture of iodine upon the integument of the lower lid with the same happy effect as in the case of the upper lid. The spasm was relieved, and did not recur, although soon afterward (from March 18th to 24th) the patient had an attack of erysipelas of the right side of the face. On April 3d she left the Infirmary.

5. *A remarkable case of periostitis of the walls of the orbit.*

A Swedish girl, aged 26 years, very blonde, but free from constitutional taint, was received at the Infirmary August 6, 1879, with marked protrusion of the right eye. The upper lid was much swollen; the conjunctiva over the nasal half of the eyeball was chemotic, and the girl complained of violent pain in the supra-orbital margin. Although the exophthalmus had existed four weeks, the sight was still remarkably good.

August 8th.—An explorative puncture was made through the upper lid near the inner canthus; but no pus was found, though the blunt-pointed probe was pushed deeply into the orbital tissue. In the following week the swelling of the upper lid became limited to the centre of the lid, where a round, pretty-well-defined, soft tumor appeared, which fluctuated so plainly that neither myself nor my assistants had the least hesitation in diagnosticating an abscess. The violent supra-orbital pain still persisted.

August 15th.—An incision below and parallel with the eyebrow was made into the supposed abscess, but it disclosed no pus, but only œdematous infiltration. The incision was carried down to the periosteum, and as this was found in a state of high inflammation, it was also freely incised. I am certain no pus escaped from under the periosteum; but I am unable to state whether or not any serous fluid was discharged from the subperiosteal space, because such fluid was continuously oozing from the œdematous tissues, and filled the wound so that an additional flow of serum from below could easily escape my attention. A

probe passed under the periosteum could be moved from right to left, and from the incision backward all over the roof of the orbit, without encountering the slightest obstacle. The periosteum of the whole orbital roof was detached. A tent was introduced to keep the wound patent for several days, but as no pus appeared, the wound was allowed to heal. The patient, however, was relieved of the great pain ; the swelling of the lid and supra-orbital region disappeared under the use of the comp. iodine ointment, and the eyeball gradually receded into its socket. But scarcely had the supra-orbital margin recovered when the same affection seized the infra-orbital margin. It became the seat of the same violent pain which had tortured the patient so long in the supra-orbital mar gin. The lower lid became œdematous, and after a few days a soft, well-defined, round tumor was developed, which also showed unmistakable fluctuation. But we decided this time to refrain from operative interference and to rely solely upon the iodine inunction. And while the affection of the supra-orbital margin had lasted two months, the same process in the infra-orbital margin ran its course in two weeks.

On the first of October the girl left the Infirmary feeling perfectly well ; but a few weeks later she returned, with pain and swelling of the *left* supra-orbital region ; and her *left* eye was protruding. This time the patient was treated in the Dispensary and recovered in a very short time, not however, until the left infra-orbital bone had passed through the same process.

6. *A piece of a gun-cap in the iris for* 25 *years.*

A few months ago a merchant, æt. 48 years, whom I was treating for an acute aural affection, mentioned incidentally that for 25 years he had been carrying a piece of a gun-cap in his right eye ; after the accident the eye had been considerably inflamed, but finally recovered without any other treatment than leeches and cold water. He could not notice any difference in sight and usefulness of his eyes.

This statement induced me to make a careful examination, which disclosed the following : *L. E.*, V=$\frac{20}{20}$, Em.; *R. E.*, V=$\frac{20}{30}$, Em. Almost in the centre of the right cornea, a little to its temporal side, there was a fine linear scar, about 1 *mm.* in length ; the right iris had the same blue color as that of the left eye ; the pupil was round while contracted, but became vertically oblong when it dilated, because of an incomplete expansion on its temporal side.

The centre of the temporal half of the iris was sunken, depressed, as if tacked down to the lens, and in this depression the sharp point of a copper-colored metallic body was seen to project from the tissue of the iris. The corresponding point of the posterior surface of the iris was fastened to the opposite point of the lens by a short white filament, which, tapering off, entered the anterior capsule of the lens to terminate about 1 *mm.* below the surface of the otherwise perfectly transparent lens substance. Vitreous and fundus showed nothing abnormal.

This observation, which I can vouch to be correct and true, indicates that the sharp and slender fragment of copper which still is lodged in the iris, had undoubtedly punctured the anterior surface of the lens. The case seemed to me remarkable for the absence of all marks of past iritis, and for the fact that the lens has not become partially or totally opaque after the puncture.

A CASE OF ADENOMA OF THE LACHRYMAL GLAND.

By ADOLPH ALT, M.D., Toronto, Canada.

Mr. H. M., dentist, from Belleville, Ontario, presented himself at my office on October 20, 1879, about a year and a half after I had first made his acquaintance at a casual social meeting, on account of a—as he thought—cystic swelling of the left upper eyelid. When I had seen him for the first time, I had noticed a small, roundish, cyst-like tumor near the external canthus of his left upper lid, and I was therefore greatly astonished to find at this consultation that the tumor had assumed a very large size.

The history of the case is as follows: About four years ago, after having received a contusion of the left temporal region, the patient perceived a painless, slowly growing swelling in the outer part of the left upper eyelid. About a year after its first appearance, a physician in Belleville tried to remove, under narcosis, what he called a sebaceous cyst. When the patient came to, he was told that some cheesy matter had been removed, but the walls of the cyst had withstood every trial at their removal. The wound caused by this operation healed without trouble, and after a short time the swelling had regained its former size. No further disagreeable symptom was, however, noticed, except, at times, shooting pain, the seat of which was thought to be the scar. After some time the eyeball was pressed a little downward, and the visual acuteness diminished. Double vision was then not complained of.

About two years ago this tumor was apparently removed by Dr. Mittendorf in New York. It is to be regretted that a letter to the doctor, asking for further data with regard to this operation, remained unanswered. It would certainly be very fortunate if Dr.

Mittendorf might be induced by this paper to fill in the missing link. He told the patient, however, that a relapse was to be feared. This relapse appeared soon, and the tumor grew gradually and continually, causing double vision and great and incessant headache.

Condition on October 20, 1879.—The left eye is looking downward and outward in such a manner that, when at rest, the edge of the lower lid lies right before the lower margin of the middle-wide pupil. The upper lid hangs down over the upper margin of the pupil, and the lower lid is pressed down by the eyeball, so as to stand about 2 *mm.* lower than the right lower lid. The skin of the upper lid is stretched and has no folds, and under it a lobular, elastic tumor is felt, reaching from the outer to the inner angle of the orbit and entering into its depth. At a small place in the centre of the tumor, a sensation like that produced by fluctuation is felt. The tumor does not move with the eyeball, and apparently adheres to the periosteum of the orbital roof. The displacement of the lower lid causes the tears to run over the cheek. The eyeball is moved easily in all directions except upward. Downward, it moves as rapidly as though it had lost its balance and fallen into the depth, as soon as the horizontal line is passed. $V=\frac{20}{100}$. Tn. F concentrically limited. The reaction of the pupil is very slow. The transparent media are normal. The arteries of the papilla and retina are anæmic, the veins very broad and tortuous, the papilla itself is whitish discolored. Color sense normal. General condition good.

The result of this examination forced me to tell the patient that I was very doubtful with regard to the supposed cystic nature of this tumor. Of course, I advised its removal, whatever it might prove to be, without, however, denying the possibility of benefiting him only temporarily.

On October 22d I performed the operation with the kind assistance of Dr. Fulton. An incision through the skin, parallel with the upper orbital margin and a few *mm.* from it, brought the tumor to view. After the tough connective-tissue capsule was severed, it was at once evident that I had to deal with a solid tumor. It was, however, of so soft a structure that it was impossible to remove it as a whole. I therefore loosened it as much as possible from the surroundings by using the handle of a scalpel, and in this manner brought out piece after piece. In the progress of the operation, I found that not only had the tumor

entered the deeper parts of the orbit, but it had also considerably pressed upward that part of the orbital roof, where we find, under normal conditions, the depression for the lachrymal gland. The larger part of the growth lay upward and outward. It was closely connected with what appeared as yet to be healthy periosteum. The parts of the tumor thus gradually removed, amounted together to about the size of a walnut. During the progress of the operation the levator palpebræ superioris had to be cut.

The operation took about an hour. The hemorrhage ensuing amounted to almost nothing. I closed the larger part of the external wound with three sutures, leaving an opening for the discharge, etc., at its inner angle. No bandage was applied.

The following night was passed without pain, but patient vomited several times. When I saw him the next day I found only very little swelling of the upper eyelid, which, of course, was somewhat suffused with blood. Some bloody serum oozed out of the wound. No headache. Pulse and temperature normal. The bulb was in a nearly normal position and moved freely.

The following day the temperature was slightly raised; pulse 72. The swelling of the upper lid remained the same, and a small amount of serum could be squeezed out of the wound. The part which was closed with sutures was united *per primam intentionem*. The outer half of the bulbar conjunctiva was suffused with blood. Patient had vomited again several times; there was, however, no other untoward symptom.

On the third day the whole of the wound was closed, and I removed the sutures. The swelling was greatly reduced, and the eyeball, in normal position, could easily be moved, even in an upward direction.

The history of this case has little more that is of importance. In eight days the patient was discharged. The scar began to contract. There was ptosis, yet no more double vision. The retina showed a slight venous hyperæmia.

According to the last accounts the ptosis was unaltered, and there was no sign of a relapse five months after the operation.

Anatomical examination.—Sections through the tumor, viewed with a low magnifying power, showed the typical picture of an epithelial new-formation. Cell-cylinders of varying caliber were seen to traverse a light tissue (which

apparently contained but few cells), and to branch off in all directions, and to anastomose with each other. In some of the sections the light tissue was more developed, in others the cell-cylinders seemed to be hardly separated by it. There were but few blood-vessels.

A high magnifying power revealed the fact that the cells of the cylinders were all arranged around an open lumen, and that the cylinders had all an endothelial sheath. This open lumen is equally well seen in transverse sections and in longitudinal ones. In most of the cylinders it takes up about a third of the thickness of the whole cylinder; in others it appears very much distended by an apparently serous exudation.

The cells of which these cylinders were formed were polyhedrous, nearly cubic, and had a large round nucleus. They formed, without exception, only one layer, and it thus appeared as if the cylinders grew only in a longitudinal direction, giving off secondary, tertiary (and so on) branches in their course. Every cylinder had a *membrana propria*. This, and an endothelial sheath at a small distance from it, apparently encased a lymphatic canal.

The tissue between the cylinders consisted of fibrillæ, long, spindle cells and stellated cells, but contained but few round cells.

Signs of a regressive (fatty or colloid) metamorphosis I could not detect.

These same conditions I found in all parts of the tumor, with this exception, that in the outer parts the cell-cylinders appeared thinner, and as being of a more recent date.

A cystoid degeneration, as the history of the case seemed to call for, was not to be found.

As it was of great interest to make sure what was the real character of this growth, I examined several normal lachrymal glands from man and different animals. Although it was clear that the compact lobular arrangement of the normal lachrymal gland was totally lost in the tumor, and sections from both compared seemed to be little like each other, there existed no other elements in the new-formation but those forming the normal lachrymal gland. The

glandular cylinders were only stretched and more numerous, and the intermediate tissue, which, in the normal gland is very scarce, was largely developed.

From this examination I think the tumor to be a simple adenoma of the lachrymal gland, which would make the prognosis certainly less unfavorable than if the tumor was to be considered a malignant growth. This prognosis seems the more correct, as for the period of five months no relapse has made its appearance. The only kind of tumor with which ours might be confounded is the glandular carcinoma. Its histological structure, however, as well as the clinical symptoms and the comparative youth of the patient, do not seem to admit of such a diagnosis.

It remains an unanswered question, after all, what connection this growth had with the alleged cyst. Had a simple abscess been mistaken for a cyst, or was it, perhaps, a retention-cyst in the lachrymal gland? Or was there a tumor besides a sebaceous cyst, or had the first attempt at operation of the cyst given the primary stimulus for the formation of the growth in the lachrymal gland?

N. B.—News of the patient has reached me a few days ago (August 6, 1880), from which it is evident that he suffers from a tumor in the cranial cavity. The eye is said to be unchanged since the operation performed by me.

AN IMPROVED METHOD OF OPERATING IN CERTAIN CASES OF SYMBLEPHARON.

By ADOLPH ALT, M. D., Toronto, Canada.

(With figures 1–4.)

SINCE relapses after the operations for symblepharon devised by Arlt, Knapp, Teale and others, were of a comparatively frequent occurrence, transplantations of various kinds have of late been introduced in these operations as apparently promising better results. These transplantations have, however, on the whole, not proved more successful in dealing with symblepharon, no matter whether the cutis or conjunctiva of man or rabbit (Wolfe, Becker and others) had been made use of. This statement refers more especially to those cases in which the symblepharon reaches from the edge of the lid and margin of the cornea down into the region where, in the normal eye, the lid-conjunctiva joins that of the bulb, *i. e.*, the fornix conjunctivæ.

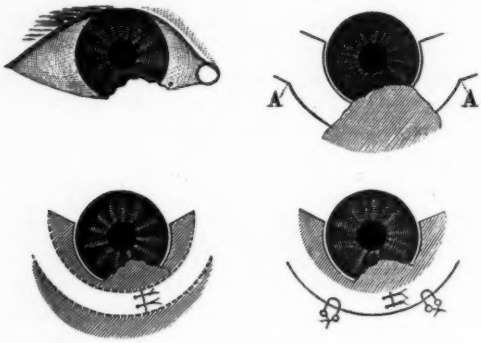
Some time ago such a case of symblepharon came into my hands for operation, and as the method of operating I applied differed somewhat from the common ones, and was apparently more successful, I thought it well to offer it to the profession for trial in similar cases.

It is, of course, not by any means impossible that others have already tried the same method—if so, this case will simply be a confirmation of what they, probably, too, experienced. There is no description of the method in the literature at my disposal.

Mr. C. H. W., of Erin Village, Ontario, the owner of an iron-foundry, consulted me on September 2, 1879, three months after having been struck by some melted iron in the right eye, because he was unable to move it satisfactorily up and outward. The history of the case had no remarkable features.

I found that the ciliary margin of the lower eyelid was firmly attached to the lower inner quadrant of the cornea. The adhesion reached down to the fornix conjunctivæ, and was very firm. The punctum lachrymale was situated just beside the place of adhesion (see Fig. 1).

It was evident that after the lid had been severed from the eyeball there would remain no flap, which, by being turned inward upon the wound-surface, might prevent reunion. I had, there-



fore, to choose between transplantation and Knapp's flap operation, in order to cover the loss of substance sufficiently to obtain that end. The former method I would resort to only in a case of extreme necessity, and Knapp's flap operation I thought capable of being somewhat improved.

One of the main objects, as in all similar cases, was, of course, to reëstablish, if possible, the free mobility of the eyeball; that is, to reëstablish a conjunctival cul-de-sac, not much differing in depth from the normal one. This I could only obtain by covering the deepest part of the loss of substance by interposing between the lid and the globe a complete coat with healthy epithelium, kept in position during the healing process. It seemed to me that the previously mentioned methods of operating did not do full justice to this point.

It now appeared questionable whether it would be better to cover the loss of substance on the lid or on the globe, and I chose the latter as the easier way. If I could succeed in keeping the covering epithelium in the deepest part of the wound, I had evidently won the game. Even if during the healing process a bridge should form between the upper parts (margin of lid and cornea), the conditions for a secondary operation would be much simplified. Moreover, it was certainly easier to prevent a reunion of these than of the deeper-seated parts.

Led by these considerations I operated in the following manner: After having severed with a knife the tough callous tissue which united the lid and eyeball, so far that the eye could be freely moved in all directions, I had before me a triangular wound surface (see Fig. ii). I now cut two conjunctival flaps in the following manner (see Fig. iii): First, I made an incision on the nasal side of the cornea, concentrically to its periphery, and about 1 *mm.* from it, through the conjunctiva, and finished it with a smaller incision at an angle of 120° from the first direction (toward the nose). Then I made a second incision about 6 *mm.* from the first, and parallel with it, bending it at the end at a similar angle, and loosened the flap. This bend in the incisions allowed, of course, of stretching the flap somewhat farther. (The tissue lying in the angle *A*, Fig. ii, retracted itself.) Then I prepared a similar flap on the temporal side of the cornea, which could be made considerably longer than the nasal flap. These two flaps were easily and without apparent traction united upon the wound surface of the ball, with two sutures piercing the lips of the flaps a considerable distance from their free edge (see Fig. iii). This conjunctival bridge left a strip of the wound surface above and below it uncovered, and consequently did not reach into the very fornix. In order to bring and hold it there I introduced two sutures, each armed with two needles, through the flaps near their lower edge, in such a manner as to draw the conjunctival bridge down into the fornix, and going with one needle through conjunctiva and episclera, and with both through the lid below the tarsus, I fastened the sutures on the outside of the lid with glass beads (see Fig. iv). In this way the conjunctiva was well secured in the fornix—provided the sutures would not cut through the tissues before union had taken place. Moreover, the two latter sutures might guard the flaps against a rupture at their vertical union by holding them in position and preventing their total retraction.

The patient was instructed not to move his eyes; the edge of the lid was freely greased and repeatedly removed from the eyeball during the following days, in order to prevent reunion.

Immediately after the operation the depth of the conjunctival sac was but little different from the normal. As I expected, it did not remain in so excellent a condition. The sutures were not removed until the conjunctiva was united to the sclerotic, and the unprotected upper parts were successfully kept apart, but gradually the depth of the new-formed conjunctival sac diminished by shrinkage. The patient had, however, three months after the operation, a cul-de-sac which was 5 *mm.* deep, and afforded a free mobility of the eye. The result is therefore quite satisfactory. Recent news from the patient show that his condition is not materially altered from that last described.

Since the case just related is perfectly like cases I have seen operated upon by skilful operators, and operated upon myself with less success, it seems to me that the slight alteration in the method of operating can really be considered an improvement.

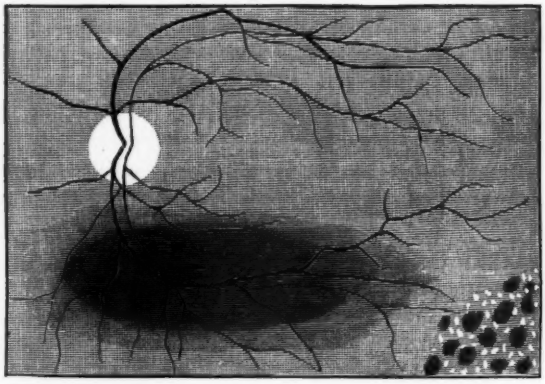
OPHTHALMOSCOPIC CHANGES FROM CONCUSSION OF THE RETINA.

By H. KNAPP.

A FEW years ago I was struck with the peculiar ophthalmoscopic appearance of an eye which the patient had hurt against a hard object. He came to the clinic the day after. His sight was somewhat dimmed, and in the outer part where the eye had been hurt, the conjunctiva was slightly œdematous and suffused with blood. The refracting media were clear, the pupil was regular in shape and mobility, the lens was in position and uninjured, but at the periphery of the outer-upper quadrant of the fundus the *retina was milky-white, interspersed with some punctate hemorrhages* in an area about four times the extent of the optic disc. This milky patch was whitest in the centre, and at the edges faded away gradually into the healthy background. There was no other abnormity in that eye. When I saw the patient again a few days after, the patch was much less opaque, having a whitish-red color, and after some days more, when I saw him again, it had disappeared, just as the œdema and suffusion of the conjunctiva. His sight was normal.

Another case of the same kind presented itself at my office, March 3, 1879. The patient was a healthy young man, M. R., æt. 19, of New York. The day before, a racket ball (a hard ball $\frac{3}{4}'$ in diameter, covered with kid leather) struck his left eye after having been repelled from the wall and his bat. He felt nauseated, and fainted for two minutes. The eye was painful. Ten minutes after

the hurt, he noticed a blur before the eye, but it soon disappeared. When he came to see me his eye felt "uneasy." His sight was $\frac{20}{20}$; he was emmetropic, his accommodation perfect, and his field of vision complete. There was some episcleral injection, the pupil was slightly oblong, being extended down and inward. It moved well. Cornea, anterior chamber, lens, vitreous, optic disc and retinal vessels normal. No rupture of the choroid in the posterior part of the globe. With the ophthalmoscope I found *a large portion of the retina milky-white*. It was an elliptical patch beginning about one papilla-diameter below the optic disc,



in the inverted image, extending with its lower border horizontally across the fundus from 2 P-DD. on the nasal side to about 10 P-DD. on the temporal side, with a breadth of about 4 P-DD. The retinal arteries and veins traversed it in their regular condition. The centre of the patch was intensely white, the borders gradually fading. Examined in the erect image a dense accumulation of white dots, coalescing in some places, especially at the lower border, could be distinguished in the diffuse milky opacity. The retina was neither raised nor folded. In the outer-lower corner of the ophthalmoscopic field of vision the fundus was somewhat veiled, but showed a cluster of small choroidal hemorrhages.

The next day the feeling of uneasiness in the eye had disappeared, the episcleral injection diminished. The milky opacity of the retina was less intense, and it appeared as if flour were strewed on a red surface. S $\frac{20}{20}$. F. complete. Ac. normal.

The following day, *i.e.*, the fourth day after the injury, the whitish opacity was still less saturated. It now looked like shagreen leather with a whitish gloss, whereas in the upper part the fundus was uniformly red and without lustre. At the lower-outer part of the fundus the hemorrhages and displacement of pigment were quite distinct.

March 8th, six days after the injury, the white opacity of the retina had completely disappeared, but extensive superficial choroidal atrophies were at the outer-lower periphery of the fundus.

I have seen the patient several times later. His eye gave him no trouble and was perfect in function.

For this peculiar white opacity of the retina I know no other cause than concussion. It resembled the opacity we notice after embolism of the central retinal artery, but the picture was still more similar to that which we see after resection of the optic nerve, when, as is frequently the case, the blood-vessels remain filled. It disappears in the same way, only more rapidly. I do not remember having seen it in other cases, though I have no doubt that it is of frequent occurrence, only overlooked on account of its evanescent character and the absence of marked and lasting functional disturbances. I wanted to put it on record as an objective symptom of concussion of the retina, which probably has been noticed also by other observers.

OSSIFICATIONS IN THE EYE.

By Dr. W. GOLDZIEHER,

LECTURER AT THE UNIVERSITY OF BUDAPEST.

Translated by Isidor Fürst, of New York.

(*With two lithographic plates, vi. and vii.*)

ALTHOUGH the literature of the osseous formations within the eye cannot by any means be called scanty, and numerous full descriptions and faithful delineations of some cases are in existence, yet this chapter of pathological anatomy cannot be considered as concluded.* In the first place, we still lack a settled view as to the genetic production of the process, and we believe that this is solely owing to the fact that at this day no unanimity exists among authors regarding the simplest *topographical* relations of the osseous formations within the eye.

This lack of unanimity among authors may be best illustrated by asking—with Knapp, to whose classical article on the present subject† we beg to refer—and first discussing this question:

"Which of the membranes and which layer of each membrane are the starting-points of the ossification?"

According to Knapp, this question is to be answered to the effect that it is the *chorio-capillaris* which is to be con-

* I cannot refrain, in this connection, from pointing to the—at the present writing, I regret, not finished—work of Kassowitz upon normal and pathological bone-formation (*Wien. med. Jahrbücher*, 1879, 2d, 3d and 4th Nos.), in which the reader will find a lucid discussion of all that is noteworthy in regard to the formation of bone, as well as a large number of new facts and ideas.

† Archives of Ophth. and Otol., Vol. ii, No. 1, p. 132.

sidered the starting-point of the process, in consequence of plastic inflammations originating in, or supplied with nutritive material by this layer.

Knapp's doctrine, however, was soon somewhat shaken. First, by a condition found by Pagenstecher,* who demonstrated a considerable piece of bone at the base of the retinal funnel in a globe with total detachment of the retina; second, by Berthold, who found bone at the posterior surface of the iris, and even published a case of an ossification taking the place and faithfully preserving the form of the lens. Older cases, too, which have been described under the title of an ossification of the lens or vitreous, cannot be overlooked, so that, indeed, it is not to be doubted that exudations other than from the choroid (properly so called) may ossify.

O. Becker† expressed himself most radically on this question. Inasmuch as—which, by the way, Knapp also stated—*every* connective tissue, not alone that proceeding from the chorio-capillaris, may ossify, the explanation of cases in which ossification occurred behind or in the place of the lens offered no difficulties. He also is inclined to consider the cases of "so-called" ossification of the lens as ossification of the vitreous, which, in eyes with detached retina, is in a state of connective tissue degeneration with vascularization, and always displaced forward.

However, all observations hitherto made force us, indeed, to the conclusion that the exudations of the *uvea*, taken in its widest sense, are the *locus prædilectionis* of bone-formation, so that we restrict the assumption that all connective tissue may ossify solely to that furnished by the uvea. But if this is the case, it follows from a simple consideration that as uveal exudations may penetrate the neighboring organs, so may the process of ossification transcend the limits of the chorio-capillaris, and we need not wonder if we, for instance, find ossification in the retina, as has been shown already by Schiess in a very instructive case, and will be shown by a similar one in the

* Zehender's *klin. Monatsbl.*, Bd. ix, p. 425,

† Page 194.

present article. In this light, the disinclination of authors to assume an ossification of the retina or even the lens, appears unjustifiable. Of course, the lens-fibres and the nervous formations of the retina do not ossify; but what was originally choroidal tissue ossifies just as little; there as here the ossification affects only tissue which is found in the domain of the organs mentioned, and which, as taught by experience, developed in consequence of plastic inflammations of a part of the uveal tract; it having been proved that ossifications are never found without such inflammations. The main point of the whole subject for the pathologist lies in this: to ascertain the condition of the uveal exudations which ossify, and *whereupon*, perhaps, the causes of this transformation may rest. Then it may be that every single case can be judged from the points of view thus gained.

The following cases are intended in the first place to furnish the proof that (1), ossification in the *retina* may establish itself from the choroid; (2), that in irido-cyclitis osseous tissue forms in cyclitic membranes situated immediately behind the lens, without forcing us to the assumption that the bone, perhaps, may have been drawn to this place by the shrinking of the connective tissue; (3), that, starting from this place, a bony shell forms, which incloses the lens and its capsule.

CASE 1.—CHOROIDITIS; OSSIFICATION IN THE CHOROID AND RETINA.

(*With Plate VI, Figs.* 1, 2, 3.)

A case similar to the one here reported may be found in the article of Schiess-Gemuseus in the *Arch. f. O.*, Bd. xix, 1, p. 303. There, too, was a plastic inflammation of the choroid and retina, starting from the innermost layers of the former, leading to an immense proliferation of connective tissue and bone-formation in a mass common to both membranes. In our case the following is to be noted.

The globe was that of a man of 45, who, some time before, had made an attempt at suicide by firing a gun against

the left half of the face. The wounds, however, had healed. The globe was crowded toward the nose and turned inward, so that barely the external half of the cornea was visible; it was immovable. In the cornea was a shallow ulcer covered with pus. There was no special injection present, as far as could be seen. Patient complained of intense pain radiating from the eye, and urgently requested enucleation, which was performed on October 16, 1879. I preserved the globe for the purpose of studying the corneal abscess.

The vitreous was liquefied; the retina was speckled, almost as in retinitis pigmentosa, chiefly in the periphery, while healthy-looking portions were present centrally, excepting the region of the macula lutea which was prominent, swelled, and of brownish discoloration. Retina and choroid were everywhere adjoining each other; on the surface of the former could still be seen a gelatinous mass, which appeared like an adherent remnant of non-liquefied vitreous.

Corresponding with this varying macroscopical appearance, the microscopical aspect likewise was changing; for while in some places the retina did not differ in any way from the normal, the most extensive alterations were present in others, where it appeared speckled even to the naked eye. In the vicinity of the papilla, the retina extending inward was nearly normal; while the external half, which was connected with the above-mentioned node (in the region of the macula lutea), was transformed into a firm, fibrous membrane; at other places it was changed into a thin, pigmented pellicle which, by a peculiar reticular tissue, adhered to the choroid, which contained masses of pigment and was likewise in a state of fibrous degeneration. (The latter is the ordinary condition in the terminal stage of atrophying chorio-retinitis.) In other places, however, the process was not one of atrophy of both membranes, but rather one of proliferation; the formation of an ample, vascularized tissue which extended into both membranes. In the region of the chorio-capillaris there appeared also nodular formations, which

proliferated into the retina, here and there still separated from it by a delicate border of pigment, but elsewhere blended with it without any distinct limitation. These nodes consisted partly of distinctly fibrous tissue interspersed with pigment, and with indications of nuclei; but partly they were nearly homogeneous, and by carmine more vividly stained than the adjoining tissue.

The entire picture, however, changed in the neighborhood of the above-mentioned swelling in the region of the macula lutea, which had a meridional dimension of about 10 *mm.*, and a height of 1½ to 2 *mm.* (see Plate vi, Fig. 1). There the quantity of blood in the choroid was much increased; the chorio-capillaris changed into a massive tissue, traversed by large, odd-shaped nets of pigment, containing blood cavities, and connecting, without distinct limitation, with the likewise thickened retina; the whole forming a tumor-like prominence, within which a casual glance showed interspersed *islands of bone*. Extending from these we recognize at once three kinds of tissue: (*a*) fully formed *bone* of lamellar structure, with stellate bone-corpuscles; (*b*) *osteoid, i. e.*, densely fibrous and in some places homogeneous tissue, but as yet free from formations of stellate lacunæ and from deposits of lime salts; finally, (*c*) *bone-forming*, identical with *medullary, tissue*, consisting of finely reticular, succulent, even embryonal-appearing tissue, in the nodal points of which there were round cells. These three kinds of tissue, which at the lateral borders were lost in indubitable retina, merge into each other. The formative or medullary tissue was present both in the interior of a fully formed bony plate, and in some of the islands within the neoplastic mass, surrounded by strings of pigment. In the former case it became more fibrous, denser as it approached the bone; the intercellular substance was replaced by numerous parallel or intersecting fibres, which radiated directly into the homogeneous mass of the bone, where they were lost. Frequently there could also be seen at the margins of the bone, both toward the medullary space and toward the outside, large cells in regular rows—*osteoblasts*—commonly already in the stage of vitrification, within which a stellate

corpuscle in place of the nucleus was often visible. Every island of bone at its margins gradually merged into osteoid tissue, which projected into the retina, part of which, especially the rapt connecting with the papilla, was changed into a dense, fibrous mass. At some points, particularly at the acme of the prominence, bone projected into the vitreous space; at others, the bone was still covered by a finely-striped fibrillar network, almost resembling fibrous cartilage, which encloses large, multinuclear cells.

It could be demonstrated that the ossification of the osteoid tissue (deposition of lime salts) was *always preceded by its becoming homogeneous*—a stage in which the outlines of the fibrillæ can barely be recognized, and especially the staining by carmine shows that the ossifying tissue resembles the appearance of the structureless masses.

The fully formed bone has a beautiful lamellar structure; the direction of the lamellæ may be vertical to each other, which can be well seen in thicker sections.

Positively deducible from the contemplation of the tissue-metamorphoses in all the preparations, was the important circumstance that all the bone present originated from a *formative tissue*, and that nothing ossified but what may be recognized as such by the formation.

We must conclude the description of this case with the statement of the most important condition it presented, namely: *Invasion of the retina by a distinctly characterized tissue, from a hyperplastic mass springing from the bottom of the chorio-capillaris; ossification of this formative substance in the territory of both membranes.*

CASE II. IRIDO-CYCLITIS; TOTAL DETACHMENT OF THE RETINA AND OF THE CORPUS CILIARE; OSSIFICATION BEHIND AND IN THE REGION OF THE LENS.

(*With Plate VI, Figs. A and B, and a drawing of the specimen in Fig. A, placed under Ranvier's dissecting microscope.*)

For the globe to be here described I am indebted to Professor Hirschberg, who sent it to me for study along with a series of others. The patient, Miss D., from whom the

object was derived, had been admitted to the clinic with the diagnosis of phthisis dolorosa bulbi dextri, and enucleation had been performed on March 13, 1877. When taken from the hardening fluid, the globe appeared slightly diminished by a flattening in its anterior portion; the section, of which the masterhand of Prof. v. Thanhoffer has given us an excellent delineation, shows the anterior chamber nearly obliterated by the adhesion of the iris to the cornea. The iris adheres also to the lens. The ciliary body and the anterior part of the choroid are entirely detached from the sclerotic, and the space formed thereby is filled partly with a purely serous fluid, partly with a spongy, pigmented tissue springing from the suprachoroid. As cause of the detachment we recognize the cyclitic membranes which divide the globe, as by a partition wall, into an anterior and a posterior segment. This false diaphragm, which has a somewhat hard feel, adheres to the posterior wall of the lens, and in one place we see a fine lamella penetrate into the body of the lens.

The retina, too, is totally detached, and extends up to the cyclitic membranes, like a rope which spreads out in front and is provided with pouch-like projections. The space between retina and choroid is filled with a curdled albuminoid mass.

One half of the globe was employed for the study of minute details; the other half was cut with Gudden's microtome into very thin sections which, mounted in damar varnish, likewise proved very serviceable.

Of the *microscopical* details, only those bearing on our question are more fully delineated, the others are merely indicated. The cornea was in a state of inflammatory infiltration; the iris largely adherent to Descemet's membrane; iris and lens connected by a dense, fibrous tissue which bends around the equator and is merged into the mass, originating in the ciliary process, to be now described. The ciliary muscle, though somewhat thinned, has otherwise a normal appearance; the entire choroid, too, though hyperæmic, shows no particular infiltration. Also, the retinal cord and funnel do not differ from the well-known pictures in retinal detachment; within the funnel

proper, I was unable to see anything like a fibrous degeneration of the vitreous, but there was here and there still an indication of the retinal layers. The mass filling the space between retina and choroid is coagulated fibrin, most deficient in cells. Of the greatest interest was the *cyclitic membrane* which *is commencing to ossify*. In it may be distinguished three well-marked portions of tissue: (*a*) a tissue between the crests of the ciliary processes and the fully formed bone, consists of numerous broad *hyaline fibres*, resembling the fibres of the zonula; of fine fibrillæ, and of a large number of vessels (many of which, descending from the ciliary processes, unite as into a collecting tube which, frequently invested with a sheath of pigment, is lost in the bone); (*b*) between the hyaline fibres a cellular tissue which thickens in the neighborhood of the bone into *osteoid* tissue; and (*c*) *bone*, which is separated from the lens capsule only by a thin layer of osteoid substance; but between the two portions of bone, the greater part of the osteoid tissue penetrates into the lens, *as the capsule is absorbed by it*, but in one place the capsule folds in a spiral manner, as we are accustomed to see it, for instance, in secondary cataract or in Descemet's membrane, where the iris is united to the wound. Where the bone touches the lens, the lens substance has undergone a peculiar metamorphosis: for some distance it has a fibrous appearance, contains numerous spindle-shaped vacuolæ (somewhat like the basis of a pyramidal cataract), but more toward the centre of the lens the lens-fibres are beginning to disintegrate, and crumbly amorphous masses have taken their places. The entire lens is closely surrounded by the osteoid tissue as by a shell, for it may be followed across the equator of the lens up to the posterior wall of the iris, where it is also intimately connected with the anterior capsule.

We observe that the section has detached the nearly normal nucleus of the lens from the periphery adhering to the bone, which was not the case before the section was made, as may be seen in Fig. A, Plate vi.

The bones (two portions connected by osteoid substance) have a peculiar lobular structure which is well brought out

by Fig. 2, Plate vii. The lobes very closely follow the several vessels extending from the ciliary processes into the bone, so that it may be said that every vessel is surrounded by a bony mantle. But here, too, is found between bone and vessel the peculiar formative tissue described in Case 1. *The connection of the processes of the stellate bone-corpuscles with the processes of the formative cells may here be traced* to perfection.* In this case, as in the former, we may see here and there on the surface of the bone *osteoblasts* placed in rows.

While we leave for final consideration the more particular discussion of the relation of the vessels to the formative tissue and the bone, we feel constrained to emphasize once more those points which prove that the fibrous shell inclosing the lens is really osteoid tissue. These are: (*a*) the direct connection of the bone with it as well as with the formative tissue; (*b*) the carmine staining, which clearly differentiates the osteoid tissue from the much folded retina and everything situated between it. This is also quite plainly shown by our faithful representation.

Thus this case may serve as proof that the lens as such may obtain an osseous shell which is capable of thickening toward the inside by apposition, and, as nutritive material is supplied in excessive quantity, after disappearance of the lens-fibres a solid osseous body of perfect lens shape may form.

In this manner may be explained the few reported cases of ossification of the lens which have been so zealously disputed by authors. At all events the view, that we had in all cases to deal with ossified vitreous, is unfounded; with greater propriety we might speak of an ossified lens, because osseous tissue, caused by hyperplastic inflammation of a membrane which is physiologically charged with the nutrition of the lens, has taken the place of this organ.

To the number of lens-shaped ossifications already reported, which I maintain have been erroneously considered to be ossifications of the vitreous, I will here subjoin an additional case which I find among my memoranda.

* A proof of the connection of the mass filling the canaliculi of the bones with the formative cells.

In the pathologico-anatomical collection of Professor Scheuthauer, at Budapest, I found, in 1876, a greatly atrophied globe, with the optic nerve, changed into a very thin string, still in connection with the chiasm. The specimen was in alcohol. I opened it at the equator and found a *bony* lens surrounded by the still well recognizable ciliary processes. Its shape and situation corresponded so closely to the shape and situation of the lens, that it would have been more than justifiable skepticism not to consider the bone as the lens. The nucleus of the bone was hollow; in it was a semifluid milky mass about the anatomical and chemical nature of which I do not find anything in my memoranda.

It is easy to understand that in a thus ossified lens the capsule cannot always be demonstrated—a fact which, *e. g.*, to Berthold, is conclusive that we have to deal with an ossification, not of the lens, but of the iris. If the bone is fully formed, the lens-capsule cannot easily be found, or, as appears probable, has perished by decay. It is likely though that there are cases in which at least a part of the capsule covers the outside of a piece of bone.

III. Pathology of the Ossification.

Already in the article of Arnold Pagenstecher,* which was written under the influence of H. Müller—a man who has done so much for the doctrine of ossification—it is stated that whatever ossifies within the eye is a *new-formed*, or at least an "*altered* normal connective tissue." Pagenstecher therefore—I can conceive the matter in no other way—emphasized that we have to deal with a tissue which either must possess, or else acquire, the proneness to change into osseous tissue. In what this quality consists is explained neither there, nor do I find any indication thereof in Knapp's article. Knapp, like O. Becker, says that every connective tissue may ossify, and pleads in favor of the chorio-capillaris as matrix of the bone-formation only because it is the chief vascular membrane of the inner eye. Aside from the fact that the conditions found by Knapp,

* Graefe's Arch. f. Ophth., Bd. vii, No. 1, p. 210.

which serve as the basis for his view of the subject, have been amplified in different directions by a series of older and more recent observations, it is difficult to see, as stated above, why bone-formation could not ensue also in other vascular and plethoric parts of the eye. Of course it is above any doubt that the process of ossification is an active and not a retrogressive tissue-metamorphosis, to the effectuation of which the coöperation of the blood-vessels is absolutely essential; but, on the other hand, if for the development of bone nothing is required but connective tissue and blood supply, it may reasonably be asked why ossifications should never be encountered in the stroma of the choroid, never in the ciliary body, nor in vascularized corneal cicatrices. The massive bony plates are always found at the inner wall of the choroid, with which they cohere solely by the entering blood-vessels; and if behind the bony plate nothing remains of the choroid but a very thin, pigmented, atrophic membrane, it should be understood that this membrane got into this atrophic condition by wearing away, after the nutrition and growth of the bone had been assured by afferent vessels. If the lens, or the fibrous, degenerated vitreous, which so frequently is connected with cyclitic membranes, should ossify, these formations would derive their blood from the ciliary body; but never does a splinter of bone project into the ciliary muscle or the stroma of the iris, just as the most anterior parts of the eye remain exempt from ossification.

From all these considerations, resting as they do on everyday observations, it seems to follow that for the establishment of ossification, besides the fundamental material of connective tissue and the ample blood supply, another factor must be taken into account, and that is the predisposition of the former to furnish the fundamental substance for bone.

It will perhaps become somewhat clearer what constitutes this predisposition, if we bring the intra-ocular ossifications into comparison with their physiological paradigm—with the *periosteal ossification*, such as we find it in its typical purity in a certain developmental period of the body, in the origin

of the bones of the skull-cap, also of the lower jaw and the clavicle, independent of cartilage.

At these places we find the ossifying tissue at first not distinguishable from the other embryonal tissue into which it continuously passes. We have to deal with cells arranged at certain distances, connecting with one another by processes, thus presenting a delicate network, and which are suspended in semi-soft intercellular substance containing here and there some free cells and nuclei (formative tissue). The bone-formation commences with the growth of the formative tissue, the cells separating, not by locomotion, but by the increase of the intercellular substance. The material for this growth is furnished by the vessels coming in large numbers from the periphery, so that the ossification establishes itself in a well vascularized tissue endowed with considerable energy of growth. Between every two vessels, cement-secreting fibres form, which fill this interspace more and more, so that the original formative tissue is situated only more in the circumference of the vessels, also in the jagged lacunæ remaining open between the fibrillæ. In these lacunæ we have the first traces of the bone-corpuscles.

The fibrillæ are formed, according to the direct observations of Kassowitz, not only by transformation of the cells, but also by alterations in the transparent intercellular substance which, according to him, is not a lifeless fluid, but endowed with the attributes of the cell, the organized protoplasm, into the finer structure of which, however, our optical auxiliaries have not yet penetrated.

After the transformation of the homogeneous mass into a mesh-work, with simultaneous development of vascular spaces, commences the deposit of lime between the fibrillæ, and therewith the bone-formation proper. At the same time, however, occurs a narrowing of the vascular (medullary) spaces by the formation of rows of cells—osteoblasts—which in time become hyaline, connect with the fibrillæ and with each other, then separate as fibres, and likewise become bearers of the incrustation of lime. In any event, of the original formative tissue only a remnant remains in the narrowed vascular spaces and within the so-called bone-

corpuscles which communicate with each other, so that we are able to inject the system of the bone-corpuscles from the medullary spaces.

The essential in the entire process described, then, consists in a rapid splitting of a tissue composed of cells and hyaline—organized, intercellular substance—into fibrillæ which, on the one hand (probably by impregnation with a cement-substance), may again assume the appearance of a hyaline mass, or, on the other hand, by the imbibition of lime-salts, may furnish the basis-substance of bone.

In what manner we may account for the deposition of lime-salts between the fibrillæ will be explained later on.

If, now, we consider the territory upon which develop those processes which lead to the formation of bone in the eye, that is, the chorio-capillaris, inclusive of the ciliary processes, we must stop first at the hyaline membrane of the choroid and its prolongations. Apparently it is a structureless membrane, but still produced by a coalescence of fine fibrillæ. Among more recent investigators it is Sattler in particular who, in a most thorough treatise,* has demonstrated that this membrane, at its external surface, *i. e.*, that directed toward the capillaries, shows the picture of a delicate lattice-work. Although this membrane in a very early stage of its development is already in the main homogeneous, we cannot fail to consider it as produced by a coalescence of fine fibrillæ. Between the hyaline membrane and the choroidal stroma are the capillaries, and in their meshes a probably semi-soft interstitial substance which, to our optic auxiliaries, likewise appears structureless, but which, as Sattler particularly emphasizes, contains here and there interspersed some minute points—a constant condition in old age, in which this substance is also separated from the capillary wall by a narrow border. If thereto we add the fact that many an investigator, whose veracity none will doubt, has directly declared it to be fibrous,† we shall have to admit that this intracapillary substance possesses a certain degree of organization.‡

* Graefe's *Arch. f. O.*, Bd. xxii, No. 2.

† Iwanoff, Handbuch von Graefe-Sämisch, Bd. i, p. 270.

‡ In the eyes of a patient who died of leukæmia I found, as I have men-

It is a universally known fact that upon the territory of the chorio-capillaris processes occur which lead to the formation of homogeneous, hyaline masses. Every one has seen the hyaline bodies which, as fungous or club-shaped appendices, are situated upon the hyaline membrane, *but which also occur beneath it* (Rudnew).* These bodies have been assumed to be simple thickenings of the hyaline membrane; but if we have to conceive that the latter has been produced by a simple coalescence of fibres, we cannot admit any other mode of origin for the hyaline bodies. And as these ordinarily are not produced through an inflammatory process, we shall not err in ascribing their derivation to a separation of fibres from the capillary interstitial substance, which fibres rapidly coalesce with each other. I cannot by any means deny the transitional forms of Rudnew, although I do not coincide with him in regard to their origin from emigrated blood-corpuscles. For in cases of pigment degeneration of the retina I have repeatedly seen such bodies insert themselves into the retina; partly they had a fibrous structure, partly they had already assumed a homogeneous appearance. I have called attention to the same condition in Case 1. Strongly in favor of this view is a case of Alt's, who in such hyaline bodies had found a genuine bone-formation.

It is well known that products derived from a hyaline membrane easily transform into hyaline masses, even if they were previously fibrous and cellular. I refer to the villous outgrowths of the membrana limitans interna retinæ. In Zehender's *Klin. Monatsbl.*, Jahrg., 1879, we find a description of a very scantily vascularized neoplastic mass, filling the space of the entire globe, undoubtedly originating in the membrana limitans interna retinæ, in which I was enabled to prove the transition of fibrillar and cellular elements into hyaline broad bands and plates, and of which I still hold conclusively demonstrative preparations.

We see, therefore, that there are hyperplastic processes,

tioned in some other place, this interstitial substance plainly fibrous, even reticulated. Sattler finds in it cellular elements in various irritative states of the eye.

* Virchow's *Arch.*, Bd. lii; (Ref. in Nagel's *Jahresbericht*).

even without particularly irritative and obviously inflammatory symptoms, which, in the domain of the hyaline membranes, especially the chorio-capillaris, proceed to the formation of finely fibrillar tissue, which eventually may become completely hyaline. This becoming hyaline I cannot imagine in any other way than that the fibrillæ become saturated with a peculiar cement substance, which gives the well-known optical effect that we produce by resins.

In bone-formation, lime salts in place of the cement are deposited in the interspaces of the fibrillæ, with co-operation of the vessels; but, at all events, every bone-formation, wherever it may occur, is preceded by a formation of fibrillæ, and we may assume that also in important *plastic* inflammations, in which, of course, a corresponding new-formation of vessels occurs, the exudations furnished by the chorio-capillaris carry with them from their source the tendency to be rapidly metamorphosed into fibrillæ, whereby they become particularly fitted for the deposition of the lime salts.

In this connection we have to discuss the rôle of the vessels in the formation of bone. This is generally interpreted to be simply the supply of the nutritive material required for the active tissue metamorphosis in bone-formation. But certainly the matter is not quite so simple. To be sure, the growth of the formative tissue, and the further alteration it undergoes until the development of osteoid tissue, depend upon the direct influence and the preponderating participation of the vessels. But from the development of the fibrillar frame-work to the ossification is a long stride, and it would appear that the vicinity of the vessels is rather a hindrance to the deposit of the lime salts than the opposite. This is proved by the fact that the deposition never extends up to the wall of the vessels, whereby the persistence of the medullary space is assured—in our cases, too, the lumina of the vessels lay, as it were, in a wide, bony mantle—moreover, that the calcification of the fibrillæ invariably commences at the greatest distance from the afferent vessels. *Bone-formation always commences at the periphery, where the current is most slug-*

gish, and progresses from there in the direction of the vessel. Direct experiments by Kassowitz * have proved even that an ample supply of blood in a bone acts positively as a solvent on its lime contents. On cutting the sciatic nerve on one side, in a growing rabbit, whereby he produced paralysis of the muscles of the vessels, and hyperæmia of the entire extremity, inclusive of the bone, there constantly ensued a thinning of the respective osseous tubes, atrophy of the bone, and a corresponding loss of gravity, proved by careful weighings, compared with the opposite side. Most probably it is the carbonic acid contained in the blood which, as proved by experiments (Maly and Donath), not only can bring lime salts into solution, but may keep them in solution, because the entire amount of these salts, which are deposited in the osseous tissue, must be kept dissolved in the mass of blood. But besides a stable amount of lime salts remaining in solution, Kassowitz assumes an unstable one which does not precipitate as long as it remains in continual motion in the blood current, but which precipitates at once when the circulating fluid containing it, at a great distance from the vessels where the current is very sluggish, comes in contact with certain tissues.

In the existence of closely packed fibrillæ which constitute the organic frame-work of the bone, whether we picture to ourselves the periosteal or the chondral bone-formation, Kassowitz sees—as ossification never occurs in non-fibrillar tissue—an apparatus acting as it were as a filter, which considerably weakens the energy of the current. Any way the formation of fibrillæ is a main factor of ossification.

In the fact to be considered as demonstrated—that the vicinity of the blood prevents the precipitation of lime salts—we find the explanation why bone never forms in the hyperæmic stroma of the choroid, of the corpus ciliare and the iris, but only in the exudations rapidly transforming themselves into fibrillæ, in the neighborhood of the hyaline membranes, especially the chorio-capillaris, and in the cyclitic membranes adherent to the fibres of the zonula.

That ossification never forms in the domain of the cor-

* Wiener med. Jahrbücher, 1879, Heft 3 and 4, p. 424.

nea is due simply to the fact that, no matter what may be the state of nutrition of the eye, in the circumference of the cornea the exit of the tissue-fluids from the eye into the lymph-channels is most active; hence there is a lack of the conditions necessary for the precipitation of lime salts.

EXPLANATION OF THE FIGURES.

Plate VII.

FIG. 1. Section through the prominence in the region of the macula lutea which contains the ossifications. (Low magnifying power, Hartnack obj. 2, eye-piece 2.) *sc*=sclerotic; *kn*=osseous tissue;
ch=choroid; *mr*=medullary space; *r*=retina; *og*=osteoid tissue, stained diffusely red by carmine, with bone-corpuscles only at the periphery; *bg*=formative tissue.

FIG. 2. A portion of Fig. 1, under high power (Hartn. obj. 8, eye-piece 2).

Letters same as in preceding figure. Here in one place the osteoid tissue extends into the retina.

FIG. 3. (Hartn. obj. 8, eye-piece 2.)

A portion of the extreme periphery of the osteoid tissue extending into the vitreous space.

Plate VI.

FIG. *A*. Globe of Case 2. Cornea, sclerotic, lens, retina, choroid, corpus ciliare, designated by their initials. The space between *ch* and *sc*, at *f*, is filled with a supra-choroidal, pigmented, fibrous network. In the neighborhood of the optic nerve the detached retina (retinal cord) was torn by the knife on section, hence the transverse lacuna which is also present in Fig. *B*. *Kn*= bone.

Further explanation in the text.

FIG. *B*. ($\times\frac{4}{1}$).

MICROTOME SECTION of the globe in Fig. *A*. Letters same as in Fig. *A*. At *r'* a pouch-shaped projection of the detached retina. Further explanation in the text. The lens is here—which was not the case before the section (see Fig. *A*)—dislocated forward, so as to leave a lacuna between it and the lens-capsule.

TENOTOMY OF THE EXTERNAL RECTUS, FOLLOWED BY ORBITAL ABSCESS AND ATROPHY OF THE OPTIC NERVE.

By Dr. C. G. HAASE,

OPHTHALMIC SURGEON TO THE GENERAL HOSPITAL, HAMBURG, GERMANY.

Translated by Swan M. Burnett, M.D., Washington, D. C.

THE subjoined case, which I tested in common with Drs. Sohège and E. Cohen, shows that a correctly-performed ocular tenotomy, which is generally considered an operation devoid of danger, may occasionally have a very disastrous termination :

Mr. V. was unfit for work during several years on account of asthenopic symptoms. The examination showed *R* M $\frac{1}{20}$; S $\frac{20}{20}$; *L* M $\frac{1}{13}$; S $\frac{20}{20}$, and an insufficiency of the internal recti of 14°. To remove this insufficiency a tenotomy of the musc. rect. ext. O. S. was made under chloroform on October 1st. After the division, the insufficiency under the covering hand was found to have disappeared, though there was a slight vertical diplopia. There was free movement of the globe in all directions. Although he had received express orders to remain quietly in bed, I found the patient, when I visited him some hours after the operation, already up and sitting by the open window. Since he had taken a light breakfast and was smoking a cigar, it is evident that neither the chloroform nor the operation had affected him badly. Although I warned him not to regard the matter too lightly, since various unpleasant accidents might follow this unimportant procedure, yet I had not the remotest conception of the consequences which were to follow this apparently successful operation.

In the course of the night following the operation, the patient had a chill. On the next morning there was œdema of the bulbar conjunctiva and prominence of the globe, which was already becoming restricted in its movements, and there was swelling of the soft parts around the eye. V was good, the cornea clear, and the iris of normal color and reaction. In spite of the most energetic treatment, a phlegmonous inflammation of the orbital cellular tissue ensued.

We will not weary the patience of the reader by recording the clinical history of the case in detail, but give only a condensed account of the further course of the case.

October 5th.—The upper lid can scarcely be uplifted sufficiently to allow an inspection of the cornea. The latter, however, as well as the aqueous, was slightly turbid ; the color of the iris somewhat dimmed ; but there was good action of atropia.

Patient states that to-day the vision in the left eye is not so good. General condition feeble ; temperature, 38.3°; pulse, 72 ; no pain in the eye. After repeated deep incisions there came away a "core" of degenerated connective tissue the size of a quill.

October 10th.—Pus secretion moderate. Bulbar prominence somewhat reduced. General condition good. An ophthalmoscopic examination gave refracting media clear ; o. d. pale ; vessels reduced in caliber, the arteries being visible only as thin threads. From this time on, the swelling of the lids gradually diminished, with a moderate secretion of pus, so that in the course of some weeks the conjunctiva assumed its normal aspect, and the movements of the globe were normal in all directions ; cornea clear and iris of normal color and reactive. Ophthalmoscopically there was a picture of a complete atrophy of the optic nerve, such as we find after gunshot injuries of the orbit ; the vessels were almost bloodless threads and the papilla was glistening white.

As a general thing we can regard the tenotomy of a muscle of the eye among the least risky and injurious operations. It is worthy of note that on the day on which the operation was performed there was a rough north-east wind, and that two of my colleagues, one of whom made an amputation of the breast, saw results similar to those above described to follow their operations.

We have, therefore, a right to refer the phlegmonous inflammation of the orbital connective tissue, which followed the

tenotomy, to an epidemic influence. As a rule, tenotomies are not followed by any reaction, and even in those cases where, in the section of the tendon, the sclera is laid bare for some extent and where there is some superficial suppuration, there are never any serious consequences.

Wecker* mentions in his handbook that in 600 strabotomies, only two accidents worthy of note have happened. In one case, a girl of 16 years was tenotomised, without his being aware of it, at the time of the menstrual flow. There was an inflammation of the capsule of Tenon, accompanied with slight exophthalmus which subsided in three days under the use of cold and calomel.

The second case was that of a professor in the conservatory of music, who was affected with a hemorrhagic diathesis. After the tenotomy, hemorrhage continued for 14 hours in spite of the energetic use of compression, ice, and the bandage.

There are, however, cases on record in which the eye has been lost after a tenotomy. Graefe† mentions the case of a woman who lost her eye by ulceration five months after a double tenotomy of the rectus externus. In this case, however, the case and conduct of the patient were so injudicious as to make this result of the operation no cause for wonder. Nagel‡ communicates a case of essential phthisis bulbi, which he traces back to an operation for squint done by him according to the modification of Liebreich.

The optic nerve atrophy observed in our and analogous cases is not due, as some authors assert, to cicatricial contraction, but is brought about by pressure and the strangulation which the nerve undergoes from the swelling of the orbital connective tissue, which is surrounded on three sides by unyielding bony walls. At least I have seen commencing nerve atrophy in two cases where there could have been no cicatricial contraction.

At all events, the atrophy in our case is to be accounted for in the same manner as that in the two cases of erysipelas of the face reported by H. Pagenstecher§ as well as the one reported by Hutchinson.‖ The last author suggests the possibility that there was blindness before the attack of erysipelas, and that the cases cannot, for that reason, be looked upon as conclusive. In

*L. de Wecker, *Traité des Mal. des Yeux*, t. ii, p. 1045.

†*Arch. f. Oph.*, Bd. iii, No. 1.

‡*Arch. f. Oph.*, Bd. xiii, No. 2, p. 407.

§R. L. O. H. R., vol. vii, p. 32.

‖*ib.*, p. 35.

our case there is no such possibility, because both eyes were carefully examined prior to the operation.

If we look over the origin, symptoms, and course of the above-described case, and compare it with the cases reported elsewhere, we must come to the same conclusion as Sonnenburg* in his work on acute cellulitis of the orbit, that the phlegmonous inflammation of the orbital cellular tissue is purely an infectious affection, and strictly analogous to the phlegmonous processes in the neck, Angina Ludwigii, for instance. I shall return to a detailed consideration of the question in the near future.

* *Deutsch. Zeitschr. f. Chirurg.*, Bd. vii, p. 493.

ADVANCEMEMT OF THE INTERNAL RECTUS MUSCLE WITH TENOTOMY OF THE EXTERNAL RECTUS; ULCERATION OF THE CORNEA WITH RESULTANT PANOPHTHALMITIS AND ATROPHIA BULBI.

By Dr. C. G. HAASE, of Hamburg.

Translated by Swan M. Burnett, M.D., Washington, D. C.

SUPPLEMENTARY to the foregoing case, I will communicate a second unfortunate termination of an operation in the general hospital, in which neither the operation nor the after-treatment could be looked upon as the real cause of the disastrous consequences.

In general, the advancement of an ocular muscle is looked upon as quite as harmless as an ordinary tenotomy.

Von Graefe* said: "After an advancement of a muscle we never have any serious accidents, or, at least, so seldom that we can well afford, according to the surgical law of probabilities, not to take them into consideration. On the other hand, the time of healing in such cases is greatly in excess of that of an ordinary tenotomy."

We have often an irritation and a tendency to inflammation on the part of the denuded sclera, and we find this especially in those cases where there has been a total detachment of the antagonist, and there is considerable gaping of the wound during the movements of the eyes. Whenever there is observed a redness or irritation, which does not disappear on the third or fourth day, but has rather a tendency to increase, and there is a manifest infil-

**Arch. f. Oph.*, Bd. iii, p. 353.

tration of the subconjunctival tissue bordering on the denuded part, and the surface of the wound becomes discolored, it is then time to commence an energetic antiphlogistic treatment.

In the case which we detail below, there were no warnings of this nature, but the destructive process manifested itself from the beginning in the cornea.

Carl v. S., 20 years of age, had a strabismus divergent of the left eye. *R* M=$\frac{1}{15}$. V=$\frac{10}{10}$. *L* amblyopia ex anopsia. Jäger 21, fingers at 6′.

The patient is a merchant, and during his sojourn in Brazil, had a tenotomy of the left eye made without any result. According to his statement, with the exception of a gonorrhœa for which he had been treated in another division of the hospital, he was in perfect health, though he appeared somewhat anæmic. There was no limitation to the movement of either eye, and the ophthalmoscope did not throw any light upon the cause of the amblyopia. The advancement of the internal rectus was made on May 22d. On account of the cicatrization of the external rectus, which had been divided before, its detachment was somewhat difficult. The left internal rectus was brought forward and united after Weber's method, and a pressure bandage applied. All went well until the third day, when there appeared at the inner limbus and parallel with it, an ulcer with an irregular bottom, occupying almost one-third of the surface of the cornea. In spite of the greatest care and all treatment, the ulcerative process in the cornea increased, and on June 5th, none of the normal tissue was left. At the upper inner quadrant, the cornea was so thinned that the membrane of Descemet was exposed. The anterior chamber was filled with a hypopyon. On June 27th perforation of the cornea occurred, and at the end of four weeks, healing had progressed so far that the patient was discharged with a painless and moveable stump, but with some conjunctival injection in the region of the advanced muscle.

The gonorrhœa for which the patient was treated before the operation, had entirely subsided, and could not be considered in any way as the cause of the inflammation. It is evident that the anæmic and somewhat exhausted condition of the patient, due to his long stay in the tropics, contributed largely to the unfortunate issue of the case. The situ-

ation of the ulcer and the commencement of the ulcerative process being at the limbus corneæ, at the place where the conjunctiva was freely dissected up for the advancement of the muscle, are strong evidences in favor of the direct participation of the operation itself in the suppurative process. I can, however, not lay the blame on the peculiar operation of Weber,* which I used with a slight modification and which I consider a most ingenious method. The unfortunate termination might have followed any other method of operating.

I will add that the sutures were so placed and cut that they did not come anywhere in contact with the cornea.

* Graefe u. Sämisch, *Arlt. Operationslehre*, p. 415.

ON THE COMMON CAUSES OF GLAUCOMA, MYOPIA, ASTIGMATISM, AND THE MAJORITY OF CATARACTS.

By Dr. W. ROEDER, of Strasburg, Germany.

Translated and abridged by H. Knapp.

(*With Plate II.*)

A PREVIOUS paper* in which I discussed the possibility of increasing S after extraction, leaving out of consideration the effect of disturbing tension caused by the zonula and capsule, induces me to return to this important subject.

After discision of the capsule the radius of curvature of some, and frequently of all, the meridians of the cornea increases in length. This increase is temporary in some, but permanent in many cases, justifying the conclusion that before the discision the cornea and sclerotic must have had a tendency to expand, and the zonula a tendency to contract, which, without artificial means, could not take effect. In advanced years, when the cornea and sclerotic have become rigid, the traction on the part of the capsule acts injuriously on the ciliary body. Schelske† measured ophthalmometrically the radius of curvature of the cornea in eyes the tension of which he artificially increased, but did not find the increase of the radius proportionate to the increase of intra-ocular pressure. I do not doubt that his

* On discision of the capsule, and consequent change of curvature of the human cornea. *Graefe's Arch.*, vol. xxiii, p. 29, etc.

† *Graefe's Arch.*, vol x, No. 2, p. 1, etc.

results would have been quite different, had he experimented on eyes in which the capsule and zonula had been either absent or divided.

Since my investigations have demonstrated that after division of the capsule the cornea flattens, consequently the eyeball dilates, it is clear that without division of the capsule and removal of the lens—which operation for itself considerably diminishes the eyeball tension—the zonula and capsule will increase in tightness with advancing years, and *this increasing tightness may justly be regarded as the primary cause of increased intra-ocular pressure in the majority of instances.* V. Graefe always believed in the presence of one cause for all forms of glaucoma, and I think that this one cause lies in the traction of the tough, elastic fibres of the zonula at the ciliary body, producing dilatation of the blood-vessels, irritation of the nerves, and increased secretion into the vitreous, *i. e.*, the well-known picture of glaucoma in its different stages. The red and white blood corpuscles, exuded into the vitreous, will at first pass through the zonula, but gradually adhere to it in greater quantity, until at last they are retained in the vitreous chamber, the zonula, like a clogged strainer, having become an impervious partition wall. The same process occurs in Fontana's spaces which may be more or less obstructed by formed elements from the blood. It will depend upon the exit, absorption or organization of these deposits, whether Fontana's spaces and the sinus of the anterior chamber are partially or totally obliterated in the manner described by H. Müller, Althoff, Manfredi, Knies and Adolf Weber. I have found another reason for the obliteration of the sinus of the anterior chamber, in small peripheric protrusions of the zonula, resulting from increased pressure in the vitreous crowding the iris against the cornea.

I do not think that the mere excision of a piece of iris can have the curative effect which we so frequently witness after iridectomy for glaucoma. I believe that in this operation smaller or larger portions of the zonula and its fibres are torn off, thus establishing a communication between the posterior and anterior departments of the eye, as well as a

relaxation of the tight zonula. These views were confirmed by the examination of a globe which I enucleated some time after I had, by an iridectomy, relieved all the irritative symptoms and increased pressure of absolute acute glaucoma. The portion of the ciliary body corresponding to the coloboma of the iris, was hollowed out. The vessels of the ciliary processes were enormously dilated and gorged with blood. The iris was found doubled up in the whole extent of the scar (Fig. *c*, plate ii); only a small part of it had been cut off. Schlemm's canal was completely open (Fig. *a*, plate ii). In some places (Fig. *a*, plate ii), Fontana's spaces were closed, in others (Fig. *b*, plate ii) they were open, though the sinus of the anterior chamber was obliterated. The scar showed no indication of filtration. The ciliary processes were stretched, most in the vicinity of the sclero-corneal scar, where the connections between the zonula and the ciliary processes were, *de facto*, torn.

These observations have convinced me to look upon the relaxation of the zonula and consequent equalization of the pressure in the vitreous and aqueous chambers as the curative effect of iridectomy and sclerotomy in glaucoma. In opposition to almost all authors (Arlt excepted) I am satisfied of a great difference in pressure between the posterior (scleral) part of the globe and the anterior chamber, in most cases of glaucoma.

In a case of double acute glaucoma, not cured by iridectomy, I incised the zonula instead of making a second iridectomy or a sclerotomy on the opposite side of the cornea. The case is as follows:

A woman of 41 years of age, had in the left eye a deep excavation, F contracted to a minimum, $+T_2$. In the right no excavation, $S=\frac{6}{6}$, $+T_1$ (scarcely), arterial pulsation. No traces of hemorrhage in either. Upward iridectomy, soon followed by $+T_3$ in both eyes. Lenses remained pressed against the corneæ. S $L=0$, $R=\frac{6}{200}$. As, in such cases, I have never seen any benefit from a second iridectomy, and only a temporary improvement from sclerotomy, I narcotized the patient deeply, thrust a Graefe's narrow knife obliquely through the corneo-scleral border of the left eye, at the place of the coloboma, advanced it as well as I

could between lens and ciliary body through the zonula, and, in withdrawing the knife, divided the zonula to the extent of from 2 to 3 *mm.* Profuse escape of vitreous. Compressive bandage. The next day $-T_1$; the patient felt relieved.

I performed the same operation on the right eye two days later; whereupon the cloudy vitreous cleared up and S rose to $\frac{6}{15}$ in three days, but for a week the tension increased steadily again in both eyes. In ten more days S *R* sunken to $\frac{1}{10}$. Supposing that the opening in the zonula had been insufficient or rather was closed again, I repeated, in a more extensive manner, the second operation in both eyes. S *R* rose again to $\frac{6}{36}$. The improvement was, however, of still shorter duration than after the first operation, and both eyes became totally blind, notwithstanding a subsequent removal of both lenses.

In the remainder of his paper (of 52 pages) the author tries to account for the development of myopia, astigmatism, and cataract, by the same factor, which he considers to be the cause of the glaucomatous process. Tension of the zonula produces mechanical dilatation of the vessels as well as irritation of the nerves in the ciliary body, which is followed by increased secretion of blood corpuscles and blood plasma into the vitreous. As long as the capsule of the eye is yielding, no appreciable increase of tension, but dilatation of the eyeball, will follow. The greater strength of the internal and external recti muscles prevents the globe from expanding as much in the horizontal as in the vertical direction, thus causing astigmatism. The traction of the zonula at the periphery of the lens (Canalis Petiti), causes a distention and partial separation of the equatorial cells from which the lens fibres are formed. This disturbance, in connection with the depraved contents of the vitreous chamber, produces cataract. Many other diseases—phlyctenular kerato-conjunctivitis, ribbon-shaped keratitis; sympathetic ophthalmia, and retinitis pigmentosa—may in their development be more or less influenced by an abnormal tightness and rigidity of the zonula and capsule.*

* The editor of these ARCHIVES will gladly send the German original of this or any other paper that appears in the English edition in an abridged translation, to anyone who desires it.—KNAPP.

Explanation of the Drawings on Plate II.

Fig. *a.*—Section from a glaucomatous eye, in which the morbid process had been arrested by an iridectomy.

Fig. *b.*—Section from the same globe at another place.

Fig. *c.*—Section through the region of the iridectomy. In this drawing, besides the scar described in the text, the numerous small cavities in the cornea are noteworthy. The cornea, hazy before the iridectomy, had cleared up after it. Microscopic examination of the enucleated eyeball showed this remarkable system of lacunæ in the cornea.

EIGHT SCLEROTOMIES ACCORDING TO WECKER-MAUTHNER'S METHOD.*

By J. HOCK, M. D.

LECTURER AT THE UNIVERSITY OF VIENNA.

(Translated and somewhat condensed by H. KNAPP.)

ONE of the unfavorable sequels of the glaucoma-iridectomy consists in the frequent occurrence of adhesions of a part of the iris at or in the sclero-corneal scar. In some cases these adhesions are the result of bad operating, in many others, however, they cannot be avoided. They are the consequence of the indispensable peripheric position of the wound, the breadth of the wound canal, especially at its borders, and, particularly in chronic glaucoma, the diminution of the elasticity and atrophy of the iris. The stump of the iris, the corner of the sphincter, and a more or less extensive part of one or both coloboma edges, may be implicated in this adhesion. Its consequences are impure and retarded union of the wound, cystoid cicatrix with constant symptoms of irritation, displacement of the pupil in the direction of the synechia, atrophy of the iris, usually at the opposite ciliary portion, and lastly, the failure to obtain the desired operative effect, *i. e.*, the diminution of pressure, followed sooner or later by a return of the glaucomatous symptoms.

The precautionary measures and technical manœuvres recommended to obviate these incidents, are mostly insufficient.

* This paper was published in the German edition at the end of the year 1878.

Attempts at reposition with Daviel's spoon, Weber's spatula, or a blunt-pointed silver probe, as well as the grasping and reducing the iris recommended by Mauthner, are commonly without avail.

On the whole it may be best, if possible, to draw forth the incarcerated piece and cut it off; but in doing this it frequently happens that a more lateral portion is drawn into the angle of the wound, and, remaining there if the iris has lost its elasticity, occasions greater stretching of the iris than the piece cut off would have done. These incidents often leave the eye in at least as dangerous a condition as that was from which the operator endeavord to free it. We would, therefore, and in spite of Von Graefe's objections, hail as a progress the simple paracentesis of the sclerotic first performed by Stellwag, or the sclerotomy introduced by Quaglino and other Italian oculists, if the frequent protrusions of the iris were not followed by the same disadvantages that were so frequently observed after iridectomy. By Wecker's method,* however, it is possible, indeed, almost always to avoid prolapse of the iris. He thrusts a narrow-bladed knife near the corneal margin into the anterior chamber, and advances it as if to form a flap-section of 2 *mm.* in height. When two-thirds of it are completed, he lets the aqueous escape by slightly raising the edge of the knife. After this, when the pupil has contracted and the iris applies to the posterior surface of the cornea, he cautiously withdraws the knife, leaving the central part of the imaginary flap-section undivided. Mauthner makes the section somewhat larger, at least 3 *mm.* on each side of the central bridge, and the section is not made by simply advancing the knife, but by sawing movements. A 1 per cent. solution of eserine is instilled before and after the operation. Wecker at present operates in the same manner.

I followed this method strictly, and, in addition, with double fixation of the globe. During single fixation the eyeball frequently preserves a considerable mobility, making the counter-punction difficult. This is of little importance in cataract extraction, but in sclerotomy for glaucoma,

* First decribed in Zeh. Mon., 1871, p. 308.

when the anterior chamber is shallow, a faulty counter-puncture cannot easily be corrected, and a lesion of the iris, which is both improper and dangerous, can sometimes be avoided only with the utmost caution. From these reasons I now operate with double fixation in the vertical meridian. While I steady the globe below, an assistant applies another fixing forceps near the cornea above.

CASE 1.—*Glaucoma absolutum amborum oculorum.*

Mrs. R. B., æt. 65. *L* —S (diminution of S) several years; S = o, one year. *R* affected the same way. S = o, six months. Moderate ciliary injection; cornea hazy, stippled; anterior chamber shallow; pupil wide, dull. *L* severe pain.

September 4, 1877.—Upward sclerotomy in both eyes. Wounds small. No accident. Still + T immediately after operation.

September 5th.—Anterior chamber moderately deep. Corneæ clear. Tension less. The place of puncture in the left eye somewhat raised. Small ecchymoses on both punctures and counter-punctures. Pain disappeared.

September 9th.—Patient discharged, blind, but free from pain. On seeing her again a few days later, I could make out the glaucomatous excavation in both eyes.

CASE 2.—*Glaucoma chronicum amborum oculorum.*

L. O., æt. 78. *R* affected a year, *L*, several months. F *R* medially contracted to median line. *L* up to 30°. S *R* $\frac{1}{1000}$ (movements of hand), *L* $\frac{3}{200}$. Corneæ hazy and finely stippled. Episcleral veins greatly dilated. Fundus indistinct. + T_2, both; pain moderate.

September 4, 1877.—Upward sclerotomy, both. No accident. Puncture larger than counter-puncture (*2½ mm.*).

September 5th.—Almost no reaction. Small ecchymoses near wounds. Corneæ bright. Cloudiness disappeared. T greatly diminished.

September 12th.—Fundus clear; deep excavation on both sides. S *R* $\frac{2-3}{200}$, *L* $\frac{10}{200}$. Tn, both.

December, 1877, and *April*, 1880.—The patient informed me that the cloudiness and haloes had not returned. He could recognize letters of the title of a newspaper about 2′ (*i.e.*, S about $\frac{2}{30}$).

CASE 3.—*Glaucoma secundarium.*

Miss E. S., æt. 22, had phlyctenular ophthalmia from her 8th to her 13th year. *R* total corneal leucoma, *L* adherent leucoma in lower half, with a fine broad pupil in upper, made in Arlt's clinic when she was 14. In April, 1877, severe pain in left eye and left half of head, lasting the whole summer, with steadily increasing impairment of sight. At the beginning of November when I saw her, I found the transparent part of the cornea diffusely opaque, the remnant of anterior chamber deepened, moderate ciliary injection, + T_3. In the whole medial part of F no perception of light, in the outer-lower part fingers at 1–2.'

November 6, 1877.—Upward sclerotomy. A greater quantity of liquid escaped than could be contained in the anterior chamber. Eye collapsed.

November 7, 1877.—Eye well filled; Tn; pain disappeared; place of puncture raised.

November 14th.—Tn. No pain. S $\frac{1}{100}$. Cystoid swelling at point of puncture.

June, 1878.—I saw the patient again. T was somewhat increased. No pain. S reduced to movements of hand. I would not hesitate to renew the operation.

CASE 4.—*Glaucoma simplex.*

L S = 0, in a man 42 years of age. T somewhat increased.

December 6, 1877.—Sclerotomy, experimenti causa; no reaction.

December 10th.—Tn. S = 0.

The day after the operation, haloes around a candle were noticed in the right eye, but disappeared soon after removal of the bandage.

CASE 5.—*Glaucoma chronicum.*

Miss B. T., æt. 60. *R* lost by acute glaucoma four years ago; iridectomy three years ago, followed by painful inflammation for several weeks. Iris adherent to scar. No pain. T increased. S = 0. *L* H $\frac{1}{3}$. S $\frac{1}{10}$. Prescribed + 9 for distance, + 6 to read with, on June 30, 1875.

November 7, 1877.—She returned complaining of — S, cloudiness and haloes in *L*. I found the anterior chamber shallow, the

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pupil responsive, greenish, F complete, the globe very tight, incipient cataract, fundus difficult to examine, S $\frac{1}{10}$ with + 8.

I kept her under observation until the end of January, 1878, when I was convinced that the physiological excavation had developed into a glaucomatous one.

January 31, 1878.—Sclerotomy. Some aqueous lost before the counterpuncture was made. During the sawing movement the iris fell before the edge of the knife and was drawn from one side to the other. After the withdrawal of the knife, the pupil was narrow. In the upper part of the iris was a dehiscence, 1 *mm.* broad. Some blood in the anterior chamber. Ocular tension not materially diminished.

January 31*st* (in the evening).—Had some pain. Anterior chamber restored. Pupil round and narrow. A drop of eserine. Morphia, 0.01 grm.

February 1*st.*—Some supra-orbital pain. +T. Pupil narrow. Eserine.

February 2*d.*—Pain ; striped hemorrhage in anterior chamber ; pupil transversely oval ; a synechia at its upper and another at its lower edge. Atropia.

February 3*d.*—Less blood in chamber. Patient feels easier. Ocular tension less.

The iritis yielded slowly under the use of atropia.

March 11*th.*—When last seen, the pupil was dumb-bell shaped from upper and lower synechiæ ; the ocular tension almost normal. S with +9=$\frac{1}{10}$ as before the operation.

CASE 6.—*Glaucoma simplex incipiens.*

Mr. U. M., æt. 65, had iridectomy made by me for advanced glaucoma simplex of his *R* eye in July, 1877. The inner corner of the wound slightly cystoid. On March 4, 1878, S $\frac{1}{10}$ as before the operation, F the same. On that day *L* cloudiness and haloes for several weeks. S $\frac{8}{10}$. Shallow excavation. F almost n.

March 4*th.*—Sclerotomy. Iris glanced by the knife.

March 11*th*,—Tn. S $\frac{8}{10}$. No cloudiness. No haloes.

Middle of *June*, 1878.—Patient presented himself again, having noticed an obscuration of sight for two weeks. I found S $\frac{8}{10}$, F complete, the excavation progressed, the eye-ball tension considerable.

An appendix to this paper (Germ edition), states that he had an attack of acute glaucoma in his left eye, July 6, 1878. S $\frac{3}{200}$. F

contracted inward. Sclerotomy, July 11th, with extension of the pupil toward the temporal part of the wound. After eserine had shown no effect in fifteen minutes, and attempts at reposition had completed the prolapse, the protruded iris was cut away. Recovery smooth. Patient discharged on seventh day. Glaucomatous symptoms disappeared. Two weeks later the condition of the eye very good. S $\frac{20}{100}$, with a diaphragm $\frac{20}{60}$. F almost normal.

The second sclerotomy in this case was performed with two lance-shaped stop-knives, of which one was thrust into the anterior chamber through the outer-upper part of the sclero-corneal border, and left in position until the other was introduced through the inner-upper part. Then both were cautiously withdrawn.

CONCLUSIONS.

Among the results obtained, Case 2 ranks first. In chronic inflammatory glaucoma sclerotomy rendered the tension normal, the media clear, and raised S *R* from $\frac{1}{1000}$ to $\frac{20}{100}$, *L* from $\frac{2}{200}$ to $\frac{10}{200}$. Seven months later, when last seen, the same good condition was still present. Iridectomy could scarcely have done as well.

In Case 1, two eyes with absolute glaucoma, the pain was removed, the media cleared, the ocular tension diminished, and the patient's eyes saved from glaucomatous degeneration. The operation achieved all that could be expected.

In Case 4 an iridectomy could not have done better than sclerotomy did, *i. e.*, reduce the ocular tension.

Cases 5 and 6 were simple glaucomas, for which, as is well known, iridectomy is of the least benefit. Von Graefe concedes that only a trifle more than 50 per cent. of these cases are cured, while the remainder require after-operations, or by the operation are severely damaged (glaucoma malignum). He omits to mention those cases in which a smooth recovery from the operation is followed by rapid decay of sight, which by a second (opposite) iridectomy is only aggravated.

In Case 3 the pain was removed and S improved by the sclerotomy, but a relapse followed in eight months or earlier, destroying sight. But the case was particularly unfavor-

able; glaucoma had developed in an eye affected with adherent leucoma, in spite of a broad and correctly executed iridectomy.

The danger of coming in collision with the iris when the knife passes through the anterior chamber, is very great in Wecker's method, and the drawing of the iris from one side to the other during the to-and-fro movements of the knife, is certainly injurious. Eserine, causing congestion of the iris, may under these conditions act prejudicially, and should be used with caution. To obviate all these dangers I shall in future operate with two lance-shaped stop-knives, as described in the after-operation in Case 6, and I shall report on the results later.

The palpable eye-ball tension is, as also Schnabel observed, not so greatly reduced by sclerotomy as by iridectomy. Our object in operating for glaucoma, however, is not to reduce the eyeball tension to the lowest degree obtainable, but only to such a one as is still compatible with the regular nutrition and function of the organ.

REPORT ON THE MEETING OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY HELD AT NEWPORT, R. I., JULY 22 AND 23, 1880.

By H. KNAPP.

As the transactions of the American Ophthalmological Society commonly appear no sooner than six months after the meeting, a short report of the proceedings may, perhaps, not be unwelcome to the readers of the ARCHIVES. The report here following is entirely personal, from notes taken at the meeting and the memory of the writer. It is intended to give a picture of this year's work of the Society, not authoritatively, to serve as reference, but as news pointing to the variety, abundance and importance of the material to be contained in the forthcoming "Transactions." The reporter knows that, with the best intentions, he could not help omitting or stating insufficiently, and sometimes, perhaps, incorrectly, subjects that were interesting and instructive.

The meeting was admirably conducted by the president, H. D. Noyes, who, together with the other officers, was reëlected. Thirty-eight papers were on the bulletin; but many of them were not read on account of the absence of their authors, and some were read by title only.

Dr. D. WEBSTER, of New York, communicated eleven cases of *sympathetic ophthalmia*, that had come to his notice partly in his own and Dr. Agnew's practice, partly in that of his colleagues.

In the FIRST THREE CASES, sight was completely lost in both eyes.

CASE 4.—Patient, æt. 28, well four days, then inflammation, ending in closure of pupil. Dr. W. made iridectomy, followed by irido-cyclitis and sympathetic ophthalmia in the other, which, however, did not lose its sight entirely.

CASE 5.—Extraction; iritis; S $\frac{15}{200}$. Inflammation in other, successfully combated.

CASE 6.—Similar to the previous. Iridotomy with Graefe's knife.

CASE 7.—*Sympathetic Conjunctivitis.* Patient, æt. 50; Graefe's extraction. Wound reopened and vitreous escaped. Iridectomy on twenty-sixth day. Rapid atrophy. Two years later, severe catarrhal conjunctivitis, treated for two months without any benefit, but got well in a few weeks after the removal of the other eye.

CASE 8.—Extraction. Seven months later, second operation. Recovery. Very severe and painful irido-cyclitis in the other eye, necessitating its removal. First eye good.

CASE 9.—Extraction; Iritis; S $\frac{1}{\infty}$; second operation with hook. S $\frac{20}{40}$. Some months later, sympathetic ophthalmia. Enucleation of second eye.

CASE 10.—Extraction; escape of vitreous; no instruments introduced; iritis. Seven weeks after extraction, iridotomy; two months later, iridectomy. Both eyes blind.

CASE 11. Extraction without accident. Iritis. Iridotomy. Sympathetic inflammation. Extraction of lens.

DISCUSSION:

Dr. MATHEWSON, Brooklyn. A case of extraction without accident, did well for five weeks. S $\frac{20}{40}$, four weeks after operation; then irido-choroiditis, soon also in the other eye; both lost.

Dr. H. DERBY, Boston. In 300 Graefe's extractions has seen no sympathetic inflammation.

Dr. E. WILLIAMS, Cincinnati. Extraction, in an old man, followed by irido-cyclitis and sympathetic ophthalmia, with loss of both eyes. It was the only case in many hundred extractions. He operates only when both eyes are blind. Other gentlemen state that they, themselves, follow the same principle.

Dr. H. KNAPP, New York, thinks this rule should not be absolute. As sympathetic ophthalmia, on the whole, is very rare, he would, in a general way, formulate the indication for any extraction as follows: "Perform the operation when it offers the greatest chances of success." External circumstances may often render it opportune to operate before or after that period, but if we want to do the greatest good to the greatest number of our cataract patients, the above rule will stand criticism. By waiting,

for example, five years until the other eye has become blind, the cataract in the first may have become hypermature and complicated. Its removal then is dangerous for both eyes, whereas at the period of maturity it was comparatively safe.

Dr. NOYES, New York, reports two cases of sympathetic opthalmia among 25 extractions.

Dr. HARLAN, Philadelphia, reports one case.

Dr. AGNEW, New York, thinks that the cases do no tall come to our notice ; he is inclined to estimate them no lower than from 2–3 per cent.

Dr. C. S. BULL, New York, read a paper on *vascular tumors of the eyelids*. Two cases were of particular interest. The one was originally a *cavernous tumor* which had been converted into a *sanguineous cyst*, probably by breaking down of the partition walls. It had developed in the orbicular muscle ; was removed with the aid of a clamp. A good deal of bleeding ensued on cutting into the cavity, but was controlled with the clamp. The wound healed by granulation in three weeks. In the other case the tumor was near the inner canthus and of long standing. It had first been noticed in infancy, and was always red ; when seen it was blue, and had attained the size of a walnut. It was cut into, emptied and removed. Recovery with some discharge. The microscope revealed that it originally was a dermoid cyst. A similar case by Schirmer in Graefe's *Arch.*, vol. vii.

DISCUSSION :

Dr. AGNEW has seen a case that reached over the brow.

Dr. KNAPP, another, lately, in a child of 15 months, from Baltimore, which at birth was the size of a pea, and limited to the skin of the upper lid near the outer commissure. It had steadily grown, involving both lids, the orbit (causing considerable exophthalmus), the side and bridge of the nose, the brow, left side of the forehead, the upper part of the left cheek, the whole left temple, and a large part on the left side of the head below and behind the ear. It was chiefly cavernous ; on the flat bones of the skull, varicose. Its removal was not thought of, nor did any other mode of treatment promise any chance of success. The case was an earnest warning, never to postpone the cure of vascular tumors of the lids as soon as they show the slightest tendency to grow. As long as they are small, or even moderately large, their complete removal is easy and safe.

Dr. LORING, Washington, communicated a case of *aneurismal dilatation of a branch of the central retinal artery*, about 1 P. D. distant from the disc. A handsome O. S. drawing of it was presented.

Dr. L. HOWE, Buffalo, related a case of *blepharoplasty by transplantation of skin without a predicle*. A girl fell into the fire face foremost. Ectropium, conjunctiva bent upon itself. Operation. The skin dissected, left a wound $1\frac{1}{2}''$ long, $1''$ high. The transplanted flap, a great deal larger, was fastened by ten sutures and covered with gold-beater's skin. On the 14th day the inner half, on the 17th, the whole of the flap discolored, and the inner half detached. Two months later the flap measured $1\frac{1}{2}''$ by $3\frac{3}{4}''$. Last seen three months after the operation. The eye looked evidently better than at first.

Dr. MATHEWSON, Brooklyn, communicated a precisely similar case. Two-thirds of the central part of the flap remained inact.

DISCUSSION :

Dr. AGNEW recommends to cut the flap with blunt pointed scissors, one branch of which can be run under the skin and advanced as cloth is cut.

Dr. KNAPP has cut and removed pieces of skin in the same way in operations for ptosis and ectropium ; for plastic operations he would prefer a sharp knife to avoid all bruising.

Dr. NOYES proposes the name *transportation* instead of *transplantation*, and takes the flaps from the chest, not from the arm.

Dr. WADSWORTH, Boston, on interpellations as to the final result of the case published by him some years ago, answered, that the patient was last seen four months after the operation. The flap had not shrunken during the last two months.

Dr. KIPP, Newark, has performed the operation four times, twice in the same person. In two instances the whole flap sloughed, in the two others the epidermis only. The effect was good at first, but the subseqent shrinkage made the ectroprium almost as bad as before.

Dr. HEYL, Philadelphia, read a long paper on *retinal lipæmia*. The case which he observed is published in the *Med. Rec.* (See Dr. Burnett's abstract in these ARCHIVES.) There was begin-

ning cataract, and a peculiar white color and enlarged blood-vessels in the fundus oculi.

Dr. KNAPP briefly related two cases of *diabetic retinitis* lately observed by him. In one, after the successful extraction of cataract, the ophthalmoscope showed the ordinary picture of neuro-retinitis; in the other, almost total blindness occurred suddenly, the fundus was milky, with a dark-red spot at the macula; the retinal vessels were dark-colored and enlarged, a picture identical to that observed after resection of the optic nerve. Sight improved to $\frac{10}{200}$, the white opacity of the retina disappeared, the disc became white, and the retinal bloodvessels shrunk so much that only two or three minute threads were seen on the papilla. Then hemorrhagic irido-choroiditis set in with great increase of tension, and pain so severe and yielding so little to eserine and other treatment, that the eye had to be enucleated. The other eye was carefully watched—but never showed any abnormity, the fundus in particular, S being normal.

Dr. LITTLE, Philadelphia, related a case of *paralysis of the superior oblique*, and another of *paresis of the inferior oblique*. Both cured. Pot. Iod., 0,30 three times daily, prisms, faradic current, and strychnia, were the remedies.

Dr. H. D. NOYES spoke on the treatment of *lacerated eyelids*. In a case of laceration of the tarsus he first united the conjunctival surface by a loop suture.

Further he described a case of *congenital coloboma of the upper lid*, presenting a small notch in the centre.

Then a case of *glioma of both eyes*. Death, autopsy. The specimen, presented at the N. Y. Path. Soc., showed macroscopically nothing but an excessive softness of the brain substance; microscopically, gliomatous degeneration of the ependyma ventriculorum and brain substance (diffuse gliomatous infiltration); no distinct tumor.

Dr. C. R. AGNEW showed a photograph of a case of *congenital coloboma of the upper lid*, operated on successfully.

In 1875 he reported a case of glioma, in which he removed both eyes. The optic nerves were infiltrated with glioma cells. The subject is still living, six years after the operation.

Dr. H. D. NOYES showed a *new ophthalmoscope* with a tilting mirror (à la Wadsworth-Loring) and two superposed discs moved by cogwheels, each disc by a separate wheel. It gives 37+and 37—glasses.

Dr. KIPP, Newark, read a paper on *keratitis from malaria.* The patients have in each attack of malaria an outbreak of superficial striped keratitis with detachment of the epithelium, and a triangular ulcer. The disease has a duration of from 6 to 8 weeks, and leaves a corneal opacity. Treatment: Warm water applications and compressive bandage, but mainly quinine and Fowler's solution, from 3 to 6 drops daily.

Dr. WADSWORTH, Boston, read a paper on *neuritis after measles*, illustrated by three cases.

CASE 1.—In the third week headache, nausea, vomiting, impairment of sight. Pupils large, sluggish. Neuritis optici. No hemorrhages. Physical condition improving. Discs atrophic. Blindness.

CASE 2.—Measles. A month later, headache; frightened. Six months later S$\frac{14}{40}$ and $\frac{14}{200}$. Defects in F. Discs swollen and opaque. Some white spots in retina. Meningitis. S=O. Impairment of hearing. Head increased in size. Death.

CASE 3.—April 29, '80. Small child. Measles, Delirium. Fever. Strabismus convergens. Impairment of sight. Anorexia. Cough. Discs swollen. No hemorrhages. July 12th: Discs normal. Paralysis of abducens. Vision apparently good.

Dr. H. KNAPP communicated a case of *ischæmia retinæ* in a young lady who, by attending on her sick father during the last six months of his life, had become anæmic and enfeebled. One morning she noticed that she could see nothing in the upper half of the F of her left eye, and four days later the lower half became dark. Knapp found the pupil of the left eye medium sized. No perception of light. Shading and exposing the left eye had no influence on either pupil; on shading and exposing the right eye both pupils moved promptly. Tests for simulation negative. Optic discs abnormally pale, arteries pulsated on pressure. Treatment: generous diet; milk punch, promenading in the forest, undisturbed sleep. Gradual complete recovery in six weeks.

Dr. KNAPP read a paper on *sclerotomy for glaucoma*, based on eight operations in six patients, made according to Wecker's method. Twice the pupil was oblong without incarceration or visible adhesion of the iris; once irreducible prolapse occurred during the operation, and the iris had to be cut off. The forms of disease for which sclerotomy was made were absolute acute and chronic, simple and chronic glaucoma, and megalophthalmus congenitus. In one case of chronic glaucoma prolapse of the iris oc-

curred four days after the operation, but reduced itself when the conjunctiva over it was divided and the anterior chamber emptied, the pupil becoming narrow, round, central, and movable as before, a unique observation in Dr. K's experience, but which it may be useful to bear in mind. The recovery was smooth in all cases; the anterior chamber reëstablished on the second day. The section was almost as large as for linear extraction. The tension was reduced, sometimes increased again later, but never to a marked degree. Dr. K. thinks that sclerotomy may be substituted for iridectomy in cases of megalophthalmus congenitus, simple chronic and subacute glaucoma, and he even considers it legitimate in cases of acute glaucoma.

DISCUSSION:

Dr. NOYES had made but one sclerotomy; pain relieved. T reduced, but gradually increased again in a low degree. No improvement of S. Ten days after the operation, outbreak of acute glaucoma in fellow eye. Iridectomy. S $\frac{20}{30}$.

In a case of *megalophthalmus congenitus* with crater-shaped pupil, he extracted the whole iris. Not much hemorrhage. In several weeks, eye the size of the other.

Dr. RISLEY performed sclerotomy once after iridectomy, followed by adhesions. Success good and permanent.

Dr. H. DERBY, Boston, performed sclerotomy in the eye of a child, iris prolapsed, the wound never healed, the eye had to be extirpated.

Dr. WADSWORTH, Boston, one case. Patient 60 years old. Acute glaucoma. S $\frac{1}{\infty}$. Downward sclerotomy in both eyes; after the operation pupils drawn downward, no prolapse. S no better.

Dr. BULLER, Montreal, one case. Tn for a month, then repeated attacks. Downward iridectomy. Result good and lasting.

Dr. J. GREEN, St. Louis, uses the old *sickle-shaped needle* for division of the capsule in secondary and soft primary cataract with great satisfaction.

He related a case of recurrence of glaucoma in an eye with hemorrhagic retinitis by one instillation of duboisine. Cured by pilocarpine.

Dr. E. WILLIAMS, Cincinnati, read a paper on two cases of *serous cyst of the iris.*

CASE 1.—Boy of 9 years. Eye injured a year ago. Linear incarceration of iris. A lobulated cyst seen to start from the iris.

Peripheric incision with a Graefe's knife, cyst cut into, collapsed, removed with adjacent iris. Six months later another smaller cyst. Last January it filled half the anterior chamber. + T_1. Removed three months later. No relapse thus far. V $\frac{15}{20}$.

CASE 2.—Eight years ago bird shot struck left eye. Inflammation for three weeks. S $\frac{1}{\infty}$. For some years a small blotch noticed on iris. Eight weeks ago, inflammation. When seen, the tension was increased, the inner half of the iris covered by a transparent cyst reaching the cornea. Sympathetic irritation in other eye. Removal of first. A birdshot found behind retina and choroid incapsulated in sclerotic, another in ciliary region. The cyst sprang from anterior layers of iris. Beautiful microscopic sections and drawings, made by Dr. SATTLER, of Cincinnati, are passed round. They show the unbroken wall of the cyst and its connection with the iris.

DISCUSSION:

Dr. KNAPP reported a case of a small (recurrent) cyst the size of a pea, which appeared dug into the tissue of the iris. Incision with lance-shaped knife by pressure upon globe, cyst prolapsed like a crystal bead, burst and was cut away with adjacent part of iris. Perfect recovery.

Dr. BULLER, another case. After removal, the lens was found opaque.

Dr. KIPP. A case in which a small shot was at bottom of anterior chamber. Near upward coloboma appeared a small cyst of the iris, which disappeared spontaneously.

Dr. AGNEW recommends incision on the side of the cyst, to be enlarged with scissors.

Dr. C. R. AGNEW, New York, showed a drawing of a *persistent pupillary membrane*, and then read a paper on the *insufficiency of the ophthalmoscope as a sole test for ametropia.* He cited a number of cases in which the refraction, as determined by himself and others with glasses and the ophthalmoscope, was considerably higher (from $\frac{1}{48}$ to $\frac{1}{14}$) than was brought out by a full action of atropia. He does not believe that the ophthalmoscope can be depended upon in very many, he might say, the majority of cases of ametropia that come before us. Puzzling cases of asthenopia, in particular, are entitled to an examination under atropia.

DISCUSSION:

Dr. KNAPP, while fully concurring in the latter proposition, cannot do so in the former. He believes that in the great majority

of cases of ametropia that come before the oculist, the ophthalmoscope and test glasses are sufficiently reliable. Full action of atropia and paralysis of the sphincter pupillæ, for instance by diphtheria, frequently show a negative range of accommodation from $\frac{1}{\infty}$ to $\frac{1}{16}$. This is not what the practitioner wants to determine, but the state of rest of accommodation. He points out the fallacies of the OS resulting from constant or periodic convergence (in which the OS brings out only the far point of the relative range of action), astigmatism and irregularities of level in the fundus.

Dr. GREEN treated a case of detachment of the retina with injections of pilocarpine. F enlarged.

Dr. HENRY WILLIAMS, Boston, used injections of pilocarpine with brilliant success in cases of episcleritis.

Dr. WADSWORTH showed photographs of sections through the yellow spot made by Prof. Arnold of New York; further, a little plate upon which are fastened six curved glasses with varying radii of curvature. By placing this plate (keratometer) near a cornea to be examined, that glass which shows an equally large reflex image determines (approximatively) the radius of curvature of the cornea.

Dr. JEFFRIES, Boston, read a paper on the *different tests of color-blindness*, with demonstrations, among others of the apparatus recently devised by Donders, for qualitative and quantitative tests of color-perception. Dr. Jeffries advocates legislative action to enforce by experts the examination of persons in the service of railways and the marine. He is supported by the Society, and resolutions to that effect are passed.

Dr. W. THOMPSON, Philadelphia, has placed fifty movable and numbered skeins of colored worsteds on a stick, the confusion tints side by side. The person to be examined is requested to match any given sample. The numbers he joins to the sample are recorded on a blank and show his correctness and mistakes. Together with tests for the acuteness of sight and hearing, this method is tried and will probably be adopted by the Pennsylvania Railroad. The examinations are made by medical men, and a general supervision by an expert.

The last paper was by Dr. HENRY WILLIAMS, Boston, on "Enervation of the Eye." The reporter regrets having been obliged to leave before the paper was read. He learned that Dr. W. had performed the operation (optico-ciliary neurotomy) ten or twelve times. In one case it had to be followed by enucleation on account of sympathetic ophthalmia.

AN ABSTRACT OF THE OPHTHALMOLOGICAL PAPERS READ BEFORE THE SECTION OF OPHTHALMOLOGY, OTOLOGY AND LARYNGOLOGY, AT THE 31ST SESSION OF THE AMER. MED ASSO., HELD IN NEW YORK, JUNE 1–4, 1880.*

By Dr. SWAN M. BURNETT, of Washington.

In absence of Dr. Pope, the chairman of the section, Dr. L. Turnbull, of Philadelphia, was called to the chair.

The first ophthalmological paper presented was by Dr. H. Knapp, on three cases of *tumor of the lachrymal gland*, together with demonstration of microscopical sections.

The *first case* was a *myxo-adenoma*, occurring in a man 31 years of age. Its first appearance had been noticed eighteen months previously. It was removed entire with its capsule, the eye replaced, and the wound closed with sutures. Perfect recovery without inflammation in a week.

The *second case* was in a man of 32 years of age. Exophthalmus 5 years. The tumor removed three years ago by a Boston ophthalmic surgeon. Recurrence manifest in two months. A large tumor, occupying the region of the lachrymal gland, pushed the eye down, forward and inward. It was extirpated by a long and tedious operation. The periosteum of the upper and outer walls had to be taken away as far as the apex of the orbit. The outer side of the sclerotic lay bare, and the optic nerve could be plainly followed with the finger. The eye had become blind, the pupil immovable, the retinal arteries small, and the veins engorged by the cutting of the retinal artery with other vessels of the orbit. The retina was milky for a week, then cleared up and the vessels

* This abstract is made up from abstracts of papers furnished by the authors, notes taken at the time, and the report in the *N. Y. Med. Record.*

shrunk. The healing was without suppuration. The globe was preserved, the upper lid immovable. No return thus far (six months) heard of. The growth is an *adenoma carcinomatosum.*

The *third case*, in a woman of 26 years, was operated on in 1865. It was a very large growth, filling the whole orbit, protruding beyond the lids, and carrying the shrunken eyeball before it. *Exenteratio orbitæ* was performed. Recovery. The specimen, which Dr. K. preserved, and, of late, re-examined, showed hypertrophied lobules of gland, cysts, areolar cancer, and myxoma. It may be classified as a *myxo-adenoma carcinomatosum.*

Dr. KIPP, of Newark, exhibited the photograph of a woman affected with an orbital tumor, showing her condition before and after the operation for removal. The history, in short, was as follows: There was downward and inward exophthalmus. An incision was made along the supra-orbital wall and the growth removed. Union of the wound by first intention without antiseptic dressing. The tumor was an ordinary adenoma. The optic nerve was atrophied, and there was pigment degeneration of the retina.

Dr. EDWARD SEGUIN then read a continuation of his paper the first part of which was read before this section of the Association last year, on the *training of idiotic eyes*, a mere abstract of which would not do the paper justice.

SECOND DAY.

Dr. TURNBULL in the chair.

The first paper was by Dr. H. KNAPP, on the *refraction of light by asymmetrical surfaces, illustrated by models.* Dr. K. said there was only one really difficult point in the chapter of astigmatism, viz.: the course of the rays refracted by the meridians situated between the principal ones. We have learned by heart that these meridians have no focus, and the rays unite in the anterior and posterior focal lines of Sturm's focal interval. To demonstrate that they can have no focus, Dr. K. had moulded a triaxial ellipsoid of beeswax, and put pins along the two principal, and some of the intermediate meridians, representing the normals of the points where they were stuck in. The model plainly showed that only the pins (normals) of the principal meridians were in one plane, but the pins of the other meridians were winding like the steps in a castle-tower staircase, forming a skew surface. When the normals are not in one plane, the refracted rays cannot be in one plane either.

The course of the refracted rays was demonstrated by one of Dr. K's older models, a thread model which has become generally known.

To determine astigmatism, in his practice Dr. K. has, from the beginning, preferred the method with cylindrical glasses and Snellen's test types. Only exceptionally he uses another method, but the above one he uses in every case of amblyopia and asthenopia. During the last years he has given a great deal of attention to the determination, not only of the existence, but also of the degree, of astigmatism with the ophthalmoscope. He spoke of the different methods that have been tried for the solution of this problem. He has cultivated only one method and finds it both sufficient and expeditious, that is, to determine the refractive condition of the principal meridians in the erect image with a good refraction ophthalmoscope. If we have learned not to accommodate, we can see whether the different (finer) blood-vessels as they radiate from the disc lie optically in the same plane or not. We have then to determine the refraction of the two meridians which are optically the most different, say the horizontal and the vertical. The fact that by seeing clearly a horizontal retinal blood-vessel, we determine the refractive condition of the vertical meridian, was made very plain by means of another model of Dr. Knapp. Four vertical pieces of pasteboard represented severally the retina, the cornea, the anterior and posterior focal lines formed in the air by the rays emanating from the retina. The rays from three points of a vertical vessel, traced through the cornea outward, formed three horizontal lines in the focus of the vertical meridian, lying the one above the other; whereas, in the focus of the horizontal meridian they formed three vertical lines which coincided, thus forming one sharply-defined vertical line. It was clearly shown that we must accommodate for the focus of the horizontal meridian, if we want to get a distinct image of a vertical blood-vessel in the background of the eye. There is as little difficulty in seeing lines sharply as there is in seeing points, say, for instance, the stippling of the choroid. The method, therefore, is practical, and for some years the speaker has used it parallel with the determination of astigmatism by lenses, as he does for ordinary cases of ametropia, and with a useful degree of accuracy. He said that in astigmatism, just as in ametropia, the ophthalmoscopic determination was frequently more reliable than the subjective determination, since the latter, in astigmatism, depended on the degree of improvement of

sight by cylindrical glasses which, as experience showed, was by no means always proportionate to the degree of astigmatism. In many cases of amblyopia, incorrigible by cylindrical glasses, a high degree of astigmatism may be revealed by the ophthalmoscope, the presence of which might otherwise escape us and lead our judgment astray.

Dr. SMITH, of Detroit, exhibited an eye in which there was supposed to be *ossification of the lens.* It was referred for examination.

Dr. E. GRUENING, of N. Y., read a paper on *Wickersheimer's preservative fluid* as a useful preparation for preserving the refracting media of the eyes intact for an indefinite length of time. The first published formula of Wickersheimer was as follows: Boiling water 3,000 parts, alum 100 parts, common salt 12 parts, carbonate of potash 60 parts, arsenious acid 10 parts. Cool and filter, and add to ten parts of this solution four parts of glycerine and one part of methylic alcohol.

According to BOERSICKE, in an article published in the *Centralbl. f. d. Med. Wissensch.*, for January, 1880, this formula contains two errors. In the formula he had from Wickersheimer there were 20 parts of arsenious acid instead of 10, and 4 parts of methylic alcohol instead of 1. This latter preparation is clear, while the former (government formula) is slightly opalescent; yet in the former the refracting media of the eye remain almost perfectly transparent, while in the latter they become opaque, the lens being attacked in a few hours, and the cornea in a day or two.

THIRD DAY.

Dr. BURNETT, of Washington, in the chair.

Dr. JEFFRIES, of Boston, read the first paper, on *color-blindness*, giving in particular the different methods for testing for the anomaly. In his examinations, which, up to date, amount to about thirty thousand, the percentage of color-blindness is about four.

Dr. D. HUNT, of Boston, on the *variability of the human eye.* H. suggests the possibility that in the variability of the human eye we have an instance of *correlated* rather than *direct* variation; that the eye being a bud of brain tissue, partakes of the inherited stimulus to increased and varied growths, and that it does not vary as its function varies. And just as growth of brain tissue has shaped the skull, so the increased growth of the retina while

it is yet a bud of brain tissue, influences the shape of the sclerotic, which is to be formed from the connective tissue immediately surrounding the embryonic retina.

In regard to staphyloma posticum, he says that the great trigeminus ganglion, the only mass of nerve-matter excepting the brain in the head of young embryos, may furnish a clue to the peculiar weakness of the temporal half of the posterior portion of the sclerotic. Increase in growth of the brain is accompanied with increase in size and differentiation of the ganglion, and other things being equal, the sclerotic will be thinner and looser in texture, as the connective tissue lying between the eye and the ganglion is encroached upon by their increased growth.

Dr. E. GRUENING, of N. Y., exhibited a *magnet for the removal of particles of steel and iron from the interior of the eye.*

G. has been experimenting for some time with various forms of magnetic apparatus with the view to making an instrument possessing the greatest amount of magnetic polarity within the least possible dimensions. He first tried a well-magnetized steel cylinder, filed to a long slender point. This, however, was not satisfactory, since its polarity was feeble and the point was easily broken. He then fitted a needle of iron into the steel magnet, and found it to act much stronger, and the needle did not become brittle. He then joined a number of cylinders together and united them with a cap at each end ; and at one end he inserted a needle 52 *mm.* long, 1 *mm* wide and 0.3 *mm.* thick. His present instrument will support a key weighing 28 grammes. In order that the instrument may not lose any of its power, it is provided with a keeper which joins the two ends, and thus keeps the current of magnetism within the magazine.

The detection of the presence and location of pieces of steel and iron in the eye by the indications of a magnetic needle, was the subject of a paper by Dr. T. R. POOLEY of N. Y. The idea was first suggested to the author by some experiments of his brother, Prof. J. H. Pooley of Columbus, on the detection of such bodies in other portions of the body. Dr. Pooley detailed at length the experiments he had made on the eyes of animals, and the conclusions he feels justified in arriving at are as follows :

1. That a steel or iron body may be detected by a suspended magnet when the body lies near its surface. 2. The presence and position of such a foreign body may most surely be found by making it magnetic by induction and then testing for it by a

minute suspended magnet. 3. The intensity of deflection of the needle is proportionate to the depth of the body. 4. Changes of deflection of the needle indicate changes of position of the foreign body. In reply to some questions by Dr. Gruening, Dr. Pooley said that the magnet was suspended by a thin fibre of silk on a rectangular support attached to a table, and at right angles over the upturned eye.

Dr. GRUENING then said that he had been experimenting for some time on this subject, and that in Dr. Pooley's method there were three sources of error: 1st, the needle should be suspended by cocoon silk in order to be perfectly free from the least torsion: 2dly, the earth's magnetism should be overcome. This he had done by suspending a strong magnet in the plane of the earth's magnetism, with its north pole toward the earth's south pole above the needle. It should be of such strength as to allow the needle to turn with perfect freedom on its axis: 3dly, the needle should be freed from the influence of draughts of air, jars, etc. The former he accomplished by enclosing it in a glass case, while the latter was hardly to be overcome at all. Having experimented with all these precautions, he was not able to say that he had obtained any trustworthy results, though the facts stated by Dr. Pooley seemed against his view of the matter. There was another point, too, of great importance. In order to have the exact locality of the foreign body, it was necessary to know the direction of the three planes passing through it. The antero-posterior and horizontal planes might be determined by the needle, but the third, the lateral plane, giving the depth of the body in the eye, could not. In his experiments he had read off the deflection of the needle by the reflection of a small concave mirror of 20 *cm.* focal distance, attached to the needle on a graduated scale 20 *cm.* from the needle.

Dr. POOLEY asked if Dr. Gruening had magnetized his foreign bodies by induction before experimenting. Dr. G. had not. This, Dr. P. said, was of the highest importance to the success of his method.

Dr. KNAPP had on two occasions attempted to remove foreign bodies from the eye by means of a magnet, in one of which only was he successful. (See these ARCHIVES, vol. ix, No. 2.)

Dr. RISLEY presented a specimen of dermoid tumor of the cornea, and Dr. Peck, of N. Y., a patient showing the present condition of a case of *lupus of the conjunctiva*, which he reported in the last number of the *Archives of Medicine.*

QUARTERLY ABSTRACT OF AMERICAN OPHTHALMOLOGICAL LITERATURE.*

By SWAN M. BURNETT, M.D., of WASHINGTON.

1. Traumatic astigmatism. By J. B. ROBERTS. *Med. Gazette*, February 21st.

Refers to the astigmatism after cataract operation, which he has found to vary from $\frac{1}{15}$ to $\frac{1}{30}$, and the astigmatism resulting from corneal ulcers. The last is mostly irregular, but still benefit is often found from the employment of cylindrical glasses.

2. Metastatic tenonitis in diphtheria. By A. G. HEYL. *Amer. Jour. Med. Sci.*, April.

The case was that of a man of 53 years, with diphtheritic exudation in the left half of the pharynx. A week after the commencement of the disease a swelling appeared under the left sterno-cleido-mastoid muscle, and at the same time the eye began to swell and project from its socket. The diagnosis of the eye trouble lay between an orbital cellulitis, thrombosis of the cavernous sinus, and tenonitis. H. decided in favor of the last, and that the metastasis took place through the lymph spaces, which he described. The connection he seeks to establish is as follows: The morbid process begins in the lymph spaces of the neck; thence it goes to the lymph spaces of the brain; thence to the intervaginal space, and from there to the supravaginal space, which is the posterior part of the space of Tenon. Those cases of eye trouble accompanying erysipelas of the face, he thinks, can be accounted for in the same manner, since it is generally admitted that the essential characteristic of erysipelas is a capillary lymphangitis.

* Authors of papers are requested to send one copy to the editor, Dr. H. Knapp, 25 W. 24th Street, N. Y., and another to Dr. Swan M. Burnett, 1215 I Street, Washington, D.C.

3. Notes of three cases of severe injury to the eye, treated almost exclusively by rest. By G. W. MURDOCK. *Amer. Jour. Med. Sci.*, April.

These cases are given "to illustrate the virtue there is in putting a wounded eye perfectly at rest, both to restrain inflammation and to prevent corneal opacity, which friction tends greatly to induce."

We believe that rest to an injured or inflamed eye has long been a recognized therapeutic measure with ophthalmologists.

4. Sarcomatous tumors of the orbit. By L. HOWE. *Buffalo Med. and Surg. Jour.*, April.

Two cases are given. In the first case, the tumor having been found to invade the eyeball, it was removed. In the second, the tumor was removed, leaving the globe intact. There has been no return in either case.

5. Report of a case of glycosuric retinitis. By H. CULBERTSON. *Detroit Lancet*, April.

C. records one case. He does not believe there is any lesion characteristic of this form of retinitis.

6. Extraction of a splinter of wood from the cornea. By D. WEBSTER. *Archives of Med.*, April.

A splinter of wood 4 *mm.* in length and 0.5 *mm.* in breadth remained embedded in the upper margin of the cornea for five months, creating no further disturbance than a localized inflammation of the surrounding tissues. It was extracted without difficulty.

7. On the relative value of the sulphate of atropia and duboisia in ophthalmic practice. By S. D. RISLEY. *Amer. Jour. Med. Sci.*, April.

R. has used duboisia in 140 cases for paralyzing A. in testing refraction. From a study of its use in these cases and in inflammatory affections, he arrives at the following conclusions: "1. That in solutions not stronger than two grains to the ounce, duboisia sulphate is free from danger. 2. That the duboisia sulphate more rapidly paralyzes the ciliary muscle than a four-grain solution of atropia sulphate. 3. That the duration of its effect is less than half that of atropia sulphate. 4. That the preparations now in the market are more liable to irritate the conjunctiva than neutral solutions of the sulphate of atropia. 5. That in the treatment of inflammations of the eye, duboisia is quite as useful as atropia, and may therefore be used as a substitute."

8. Three anomalous cases of glaucoma. By J. L. MINOR. *Va. Med. Monthly*, April.

In one of the cases the glaucomatous attack was thought by the author to be caused by the use of eserine, though as there was at the same time a dislocation of the lens into the anterior chamber, it would appear to be by no means certain.

9. Pathological relation of certain ophthalmic phenomena to tabes dorsalis (locomotor ataxia, post. spinal sclerosis, etc.). By WM. DICKINSON. *Alienist and Neurologist*, April.

The history of a case showing the progress of a gray atrophy accompanying locomotor ataxia.

10. Scotomata. By WM. DICKINSON. *St. Louis Med. and Surg. Jour.*, April.

Histories of twelve cases of scotoma dependent upon choroidal disease.

11. A remarkable descent of congenital cataract, running through four generations, and showing fifteen cases in the history of a single family. By A. D. WILLIAMS. *St. Louis Med. and Surg. Jour.*, April 5th.

12. A new operation for symblepharon and permanent cure. By E. MCFARLAN. *N. Y. Med. Record*, April 10th.

The attachment was below. The lid was dissected up and a pin passed horizontally through the integument; another pin was passed through the cheek parallel to this one, and the two were united by a figure-of-eight ligature, thus producing a temporary ectropion. As soon as the conjunctiva had healed, the ligature and pins were removed and the difficulty was found to be permanently relieved.

13. A case of total symblepharon of the upper and lower lids of both eyes. Operation on one with good recovery of vision. By P. D. KEYSER. *Phila. Med. Times*, April 10th.

The symblepharon was caused by a membranous conjunctivitis and was complete in both eyes. The cornea was covered with a skin-like membrane, allowing only perception of light. The operation consisted in cutting this skin in two, and detaching it from the transparent cornea to which it was lightly adherent, and turning it down under the upper and lower lids, with the result that after two years he can count fingers at 10′ and read Sn. 14 at 6″.

14. The parasitic theory in ophthalmology. By W. W. SEELY. *Cinc. Lancet and Clinic*, April 17th.

Dr. S. puts himself on record in regard to this theory as fol-

lows: "The danger in all conjunctival inflammations is corneal complication, and that that complication comes from infection, I believe, will hardly be denied; and, furthermore, that the infection arises from losses of corneal epithelium allowing entrance to the germs; and, furthermore still, that in a vast number of cases the erosions are brought about by the officiousness of the surgeon and his injurious remedies I firmly believe."

15. Enervation of the globe of the eye. New method of operating. By EUGENE SMITH. *Mich. Med. News*, April 26th.

The modification in operating which Dr. S. makes is the following: Instead of dividing the external rectus, he makes a meridional incision between the internal and inferior recti through the conjunctiva and capsule of Tenon. The nerves are then cut by passing the scissors through this opening. A similar opening is made above, between the superior and external recti, thus giving an abundant opportunity for a thorough denuding of the posterior portion of the eye. He reports one case where the sensibility of the cornea slowly returned, and the sympathetic trouble was renewed several weeks after the operation, necessitating removal.

16. The value of salicylic acid in the treatment of rheumatic diseases of the eye. By F. C. HOTZ. *Chicago Med. and Surg. Exam.*, May.

Four cases of acute iritis of probable rheumatic origin are given, in which salicylicate of soda was administered, in addition to the usual treatment, with good results; and two cases of paralysis of the motor oculi nerve were much benefited by salicylic acid in doses of 0.15 to 0.25 every three or four hours.

17. Circumscribed cortical optic neuritis. By D. S. REYNOLDS. *Med. Herald*, May.

Five cases are given in detail, in three of which syphilis was believed to be the cause.

18. On the occurrence of sympathetic ophthalmia consequent upon linear extraction of cataract. By M. LANDESBERG. *Med. and Surg. Rep.*, May 1st.

L. gives five cases in detail.

19. Irideremia, or total absence of the iris. By G. S. RYVERSON. *Canada Lancet*, May.

Two cases are related, and reference is made to the other reported cases.

20. On the prevention of near-sight in the young. By R. H. DERBY. *Bost. Med. and Surg. Jour.*, June 5th.

Dr. D. recounts the evil influences which have been found in constant association with progressive myopia. These are well known to specialists. He advises, of course, their removal, and suggests that the vision of school children be examined at least twice a year, and when a defect is noticed that it be treated immediately.

21. On gonorrhœic irido-choroiditis. By C. J. KIPP. *N. Y. Med. Record*, June 26th.

K. gives the detailed history of three cases in which there seemed to be no doubt of the connection between the uveal inflammation and a urethral discharge.

22. A unique case of conjunctival lupus. by E. S. PECK. *Archives of Med.*, June.

The patient was a girl of 9 years, first seen in May, 1879. The ulcer at that time was on the left upper lid, with its outer end at the external canthus, with the inner end and lower margin at its tarsal border. The ulcer was ovoid, 7 *mm.* long, 3 *mm.* broad, with a granular floor, coated with a clean white secretion, and a well-defined, somewhat irregular wall, not sensitive to touch, and bled easily on probing. It was treated by fused probe of nitrate of silver. The ulcer healed in about a month, but since that time there have been three recurrences on different parts of the lids and conjunctiva, one existing at time of writing, May, 1880.

23. Certain traumatic lesions of the bones of the orbit, with caries and perforation. By C. S. BULL. *Amer. Jour. Med. Sci.*, July.

Four cases are given in detail:

1. Lacerated wound of the superciliary ridge and orbital margin.
2. Pistol wound of the orbital ridge and margin.
3. Pre-lachrymal abscess; caries and perforation of the lachrymal bone of traumatic origin.
4. Lacerated wound of the upper lid and orbit; perforation of the orbital plate of the frontal bone; meningitis; death.

24. A case of mixed astigmatism, supposed to have been caused by the sucking of the eye by an infant. By D. WEBSTER. *N. Y. Med. Record*, July 10th.

One eye was emmetropic, the other had V. $= \frac{8}{10}$, but it was raised to $\frac{8}{10}$ by $-\frac{1}{10}$ c, axis 70°, combined with $+\frac{1}{48}$ C, axis 160. Vision in the lost eye was said to have been normal until after a period when to quiet her infant she allowed it to suck her eye.

25. The anæsthetic effect of cold upon the cornea as a therapeutic measure. By H. S. OPPENHEIMER. *N. Y. Med. Jour.*, July.

For the relief of all those symptoms due to hyperæsthesia of the cornea, photophobia, pain, blepharospasm, etc., O. was induced to try melted ice dropped into the eye. He has found it useful in all forms of corneal inflammation, except, perhaps, the suppurative.

He directs the water to be dropped in the eye every few minutes from half an hour to an hour, lengthening the interval as the symptoms improve. He has used it in 25 cases.

26. On the nature of cataract and its treatment by electricity, with the report of a case. By E. EVETZKY. *N. Y. Med. Jour.*, July.

Dr. Neftel is the originator of the recent discussion of the influence of electricity in the progress of cataract, by his article in Virchow's *Archives*,, Bd. 79, p. 465. The extravagant claims there set forth, and further promulgated in this country through the columns of the *Churchman* newspaper, have been successfully met by Drs. Knapp, Agnew and Webster in letters published in the *N. Y. Medical Record* under the dates of May 15th, 22d, 29th, and June 12th, to which letters the reader is referred who is desirous of following the matter in detail. Dr. E's article is an attempt to show in what manner electricity might exert a favorable influence in the progress of cataract, but the case he cites in illustration fails to support his belief, because at the end of the treatment V. was much worse than at the beginning. It is true V. was at one time found to be better than at first, but the circumstances under which the test was applied are not given. This is an unfortunate omission, since, as Dr. Knapp remarks in one of his communications, persons affected with central cataracts (as in this case) have very variable vision, according as their pupils are larger or smaller under the influence of light.

27. Optico-ciliary neurotomy, the proposed substitute for extirpation of a lost and painful eyeball. By J. J. CHISHOLM. *Transactions Medical and Chirurgical Faculty, Maryland*, 1880.

Up to the date of publication of the paper C. had done 10 operations, in two of which he had to subsequently enucleate, after a lapse of three weeks in one and of five months in the other.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY FOR THE SECOND HALF OF THE YEAR 1879.

(*Continued from Vol. ix. 2. p.* 253.)

By Dr. H. MAGNUS, of Breslau, and Dr. A. NIEDEN, of Bochum.

Translated by Dr. R. O. Born, of New York.

I.—ANATOMY. By Dr. H. Magnus.

476. Alt. Normal and pathological anatomy of the eye. With 95 wood-cuts, drawn from his own preparations. (*Wiesbaden, J. F. Bergmann*, 1880. *The English edition by G. P. Putnam's Sons, New York.*) A compendium of the normal and pathological anatomy, important and indispensable to the teacher as well as to the general practitioner. Alt has laid more stress upon the pathological conditions, and less extensively described the normal structures. A great number of most instructive engravings, drawn from nature by the author, materially increase the value of the book and facilitate the understanding of the pathological processes. The book really fills a long-felt want in our literature, and will greatly contribute to the study of the pathology of the eye.

477. Carl, Duke of Bavaria. Contributions to the anatomy and pathology of the vitreous body. (*A. f. O.*, vol. xxv, 3.)

478. Denisenko. The inner granular layer of the retina. (*Medizinskoje Obosrenje*, August, 1879.)

479. Duval. Sur l'origine embryonaire de la région lenticulaire. (*Soc. de Biol.*, June 21, 1879; *Gaz. Méd. de Paris*, No. 29.)

480. Duval. Origines du nerf trijumeaux. (*Soc. de Biol.*, Nov. 22, 1879.)

481. Duval. Origine réelle des nerfs moteurs des yeux.

(*Méd. Française*, Oct. 25, 1879; comp. also *A. O.*, vol. ix, 1. p. 97 No. 6.)

482. EWETSKY. Contributions to the development of the eye. (*A. O.*, vol. viii, p. 429.)

483. FOURNET. De la persistance du cordon hyaloidien. (*R. d'O.*, Sept., 1879.) A soldier has in both eyes a string which from the od. runs forward, and before it reaches the lens, is dissolved into delicate threads; the one in the right eye pulsates. In another case a cord comes from the atrophic optic disc and terminates in the posterior pole of the lens with a shining head.

484. FROMMANN. The structure of the ganglionic cells of the retina. (*Med. Naturwissensch. Ges. zu Jena Sitz.*, Feb. 21, 1879; *Jenaische Zeitschr.*, vol. xiii, supplement 2, p. 51.)

485. GRABER. Morphological examinations of the eyes of the loose marine bristle-worms. (*Arch. f. Micr. Anat.*, vol. xvii, p. 3.)

486. GRÜNHAGEN. The cerebral course of the dilator nerves of the pupil. (*Verein f. Ærztl. Heilkunde zu Königsberg*, Apr. 28, 1879; *Berl. Klin. Wochenschr.*, No. 43.)

487. GUDDEN. The crossing of the nerve fibres in the chiasm. (*A. f. O.*, vol. xxv, 4. Comp. *A. O.*, vol. ix, 1, p. 97, No. 9.)

488. HAAB. The color of the yellow spot and the entoptic perception of the visual purple. (*Z. M.*, vol. xvii.) The red area in the well known entoptic figure of Ewald has nothing to do with the visual purple, but belongs to the outer zone of the so-called macula lutea. The fovea during life has a yellow color, which, under certain circumstances, disappears after death. The yellow color of the macula becomes less intense and smaller after death, probably also during life after the use of santonin. The yellow-green seeing has, however, no connection with this.

489. KÖNIGSTEIN. The termination of Descemet's membrane. (*A. f. O.*, vol. xxv, 3.) Descemet's membrane does not terminate with a sharp edge, neither is it dissolved into a peripheral system of elastic plates and fibres, but it surrounds the processes of the iris and the trabecular tissue, is, as it were, fused around them during their development. It must, therefore, terminate at the margin, partly like glove fingers, partly like fringes. The processes of the iris are not inserted immediately behind the margin of Descemet's membrane, but in the adults they perforate it and ramify upon its outer surface. The so-called *Henle's* warts indicate probably the places where the trabecles of the ligamentum pectinatum are perforated.

490. KÜHNE. Note on the color of the retina when exposed to light. (*Untersuch. a. d. phys. Inst. d. Univers. Heidelberg*, vol. iii, 1 and 2.)

491. KUHNT. A new endothelial plate in the eye. (*Report of the 12th meeting of the Heidelberg Ophth. Society*, Rostock, 1879, p. 36, *Z. M.*, vol. xvii, supplement.) Upon the anterior surface of the ciliary body down to the insertion of the iris an endothelial membrane could with certainty be demonstrated.

492. KÜHNT. Contributions to the knowledge of the optic nerve and retina. (*A. f. O.*, vol. xxv, 3.)

493. MÄHLY. Contributions to the anatomy, physiology and pathology of the ciliæ. (*Inaug. Dissert.*, *Z. M.*, vol. xvii, supplement.)

494. MAUTHNER. Hemiopia. (*Vortrag in der wissensch. Vers. d. Wiener med. Doct.-Coll.*, 24 Mærz, 1879, *C. f. A.*, p. 316.) He states as to the origin and course of the optic nerve fibres: The centres are in the posterior lobes of the cerebrum; from there the fibres pass through the intercalated ganglia: thalami optici, corpora quadrigemina and geniculata; they emerge as optic tracts—until then without a partial crossing of the lateral bundles—; they are partially crossed in the chiasm and finally pass, united into one bundle, as optic nerve of either side and are expanded in the retina, but in such a manner, that in each optic nerve the main portion of the fibres comes from the opposite side of the cerebrum.

495. MEYER. The terminations of the nerves in the iris. (*Arch. f. Microsc. Anat.*, vol. xvii, 3.)

496. MORANO. Krause's corpuscles in the human conjunctiva. (*Atti del Assozione Ottalmologica Italiana, Riunione di Napoli*, Settembre, 1879, *Z. M.*, vol. xviii.)

497. MORANO. The stomata of the endothelia of the lens-capsule (*Ibidem*). Morano thinks that, some time ago, he demonstrated intercellular spaces in the pigmentary layer of the retina of the frog, and says he has now found similar stomata also in the capsule of the lens. The endothelium of the capsule consists, according to him, of a double row of cells, a superficial and a deeper one. The flat, hexagonal, protoplasmic, nucleated cells adhere to one another. In the spaces between them, Morano found vacuoles. In the interior of the vacuoles we find three or more valve-like projections which leave only a small lumen; these valve-like structures are best seen at the equator of the lens.

498. D'OENCH. Contributions to the knowledge of congenital ectopia lentis. (*C. f. A.* vol. ix, p. 31 ; will appear in the English edition of these ARCHIVES.) Careful bibliography. The results are as follows : 1. Ectopia lentis is a formative defect, the causes of which are not yet explained. 2. It always affects both eyes, in most cases symmetrically. 3. The dislocation is almost always upward, up- and inward, or up- and outward. 4. Most frequently (about 80 per cent.) the lenses remain clear ; they are often smaller than normal. 5. The zonula Zinnii can either be present or wanting. 6. It is connected with myopia in about one-fourth of the cases. 7. It may remain stationary during the whole life, or develop into spontaneous luxation. 8 Heredity plays a part in its etiology.

499. PUFAHL. Corectopia. (*C. f. A.*, 1879, p. 293.) From literary search and two personal observations, it follows that the displaced pupils have but rarely the normal, round shape ; their place differs ; they are situated mostly up- and outward, but also up- and inward, rarely down- and inward and most rarely down- and outward ; frequently, but not always the iris is tremulous. The lens is mostly dislocated, frequently in an oblique position, in some cases even freely movable. Some patients see with, others without the lens, according to its position. The acuteness of vision is commonly reduced.

500. SCHWALBE. The ganglion oculomotorii. (*Jenaische Zeitschr. f. Naturwissenschaft*, vol. xiii, new series, vol. vi, 2. Comp. *A. O.*, vol. ix, p. 98, No. 17.) The ciliary ganglion is a ganglion of the oculomotor nerve ; a connection with the sympathetic can be demonstrated only in some classes of vertebrates ; in birds, reptiles, amphibia and fishes, such a connection is entirely absent. In man the connection is not so that the so-called sympathetic root could be demonstrated microscopically as a simple nerve twig. Neither does the ciliary ganglion belong to the trigeminus. In higher vetebrates, from the reptiles upward, the ciliary ganglion, or the ganglion oculomotorii is always single. As to its connection with the oculomotor nerve, all possible transitions are observed from a complete admission of its ganglion cells into the trunk of the nerve, to a separated, pedunculated ganglion with a radix brevis. Schwalbe has distinguished the four following conditions : 1. The single or multiple ganglion lies entirely within the oculomotor nerve, its ganglionic cells diffusely scattered between the nerve fibres. 2. The ganglion lies close upon one side of the ocu-

lomotor nerve, frequently causing only a small microscopical, lateral swelling of the nerve. 3. The ganglion is more developed, and projects, as a considerable lateral swelling, more or less over the surface of the nerve. 4. A radix brevis can be demonstrated.

The place of connection of the ciliary ganglion with the oculomotor nerve varies very much. The ciliary ganglion resembles a spinal ganglion. The oculomotor nerve contains the elements of a dorsal and ventral root, thus becoming an independent cranial nerve constituted according to the type of the spinal nerves.

501. STILLING. The central origin of the optic nerve. (*Report of the 12th meeting of the Heidelb. Ophth. Soc.*, Rostock, 1879, *Z. M.*, vol. xvii, supplement, p. 203.) We know the following roots of the optic nerve: 1. the branch which enters the thalamus, partly by way of the corpus geniculatum laterale; 2. the well known branch which goes to the corpus geniculatum mediale; 3. the superficial branch which we see passing directly to the corpora quadrigemina; 4. the root from the pedunculus cerebri; 5. that from the tuber cinereum; 6. that from the substantia perforata antica; 7. that from the surface of the thalamus opticus.

502. TARTUFERI. Sull' anatomia minuta dell' eminenze bigemine anteriori delle Scimmie (*Rivista Sperimentale Freniatria*, 1879, Settembre.) The structure of the anterior corpora quadrigemina in man and the other mammals is said not to be different, as was heretofore generally supposed, but the same.

503. THIN. Nerve fibres and ganglion cells of the retina of mammals. (*Journ. of Anat. and Phys.*, Jan., 1879.

504. DI VICENTIIS. The lymph-vessels of the ocular conjunctiva. (*Atti dell Assoz. Ottalmol. Ital. Riunione di Napoli.* 1879, Settembre, *Z. M.*, vol. xviii.)

505. WEISS. The avenues of exit of the intra-ocular fluids. (*A. f. O.*, vol. xxv, 2.)

II.—PHYSIOLOGY.

CORNEA, IRIS, CILIARY BODY.

506. HÖYGES. Contributions from the Institute for General Pathology and Pharmacology of the University of Klausenburg. Changes of the eye after extirpation of the facial nerve. (*Arch. für experim. Pathologie*, Bd., xi, 4). After a simple division of the facial nerve, exsiccation patches repeatedly appear and disap-

pear on that portion of the cornea of the operated side which had remained uncovered by the lids, usually without deeper tissue changes, but if the facial nerve is torn out, the desiccation will be followed by abrasion, ulceration and inflammation, *i.e.*, by more important alterations of structure, which, however, will disappear again after a shorter or longer time.

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507. ACKROYD reports on long-known movements of the iris. (*Journ. of Anat. and Phys.*, Jan., 1879.)

508. BARRAQUER. Reflex-mydriasis and paralysis of accommodation. (*Gac. Med. de Cataluna*, 1879, vol. ii., p. 203.)

509. DOJER demonstrated at the Sixth International Medical Congress at Amsterdam, a pupillometer. The instrument consists of two sliding tubes; at one end an objective-lens of 20 *cm.* focus; at the other a magnifying eye-piece with micrometer (1 *cm.* divided into 100 parts); besides, a frame in which the eye is to be examined is placed at a distance of 40 *cm.* from the objective. The objective produces 40 *cm.* behind its posterior surface an inverted image of the pupil, equal in size to the object, which is looked at with the eye-piece and measured with an accuracy of $\frac{1}{10}$ *mm.* (*C. f. A.*, 1879, p. 662.)

510. EVANS reports measurements of the pupil. (*Brit. Med. Journ.*, 1879, p. 662.)

511. FRANCK speaks of the physiology of the Ansa Vieussenii (a double connection between the middle and lower cervical ganglia of the sympathetic nerve), in the *Soc. de Biol.*, July 10, 1879. (*Progrès. Méd.*, 1879, p. 585.) If in an animal, which has been poisoned by curare, the anterior branch of the ansa is ligated, a transient, and therefore reflex dilatation of both pupils ensues. If the anterior branch is divided, the irritation of the peripheral end will produce mydriasis on the same side; irritation of the central end, however, mydriasis on both sides. In the posterior branch of the ansa there are no fibres which produce a dilatation of the pupil. (Comp. also *Gaz. Méd. de Paris*, No. 41.)

512. GYSI AND LUCHSINGER. The reaction of the iris of the eel on colored light. (*Centralbl. f. d. Med. Wissensch.*, No. 39, Sept. 27.) The iris of a recently killed eel, which has been carefully removed, is strongly contracted in sunlight, even after the light has passed through thick layers of ice; the radiation of

heat has, therefore, nothing to do with it. The blue and green rays always acted more powerfully, the red rays less, the yellow still less, and the ultra-violet not at all.

513. HOLMGREN observed in a decapitated criminal contraction of the pupil five minutes after the execution, and dilatation of the pupil only after two minutes more. (*Upsale Läk. Förk.*, 1879.)

514. PLOTKE. Condition of the eyes during sleep. (*A. f. Psych.*, vol. x, p. 205. Comp. *A. O.*, vol. ix, p. 102, No. 69.)

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515. BIESINGER. Researches on the relation between accommodation and convergence. (*Inaug. Dissert., Tübingen*, 1879.)

516. ROSSET replies to Dr. Hunt's remarks on ROSSET'S theory of accommodation (*New York Med. Journ.*, vol. xxix. Comp. *A. O.*, vol. ix, p. 102, No. 69.)

517. SCHMIDT-RIMPLER. Accommodation. (*Realencyclopadie der gesammten Heilkunde.* Edited by Dr. A. Eulenburg, Vienna, 1880, 1st and 2d number.)

REFRACTING MEDIA, RETINA, OPTIC NERVE AND CENTRAL ORGAN, PHYSIOL. OPTICS AND COLOR-SENSE, OCULAR MUSCLES, LACHRYMAL APPARATUS.

518. HEUBEL. The action of hygroscopic substances, especially on the crystalline lens. (*A. f. d. ges. Phys.*, vol. xx, 1 and 2.) The cataract artificially produced by sodium chloride, sugar, etc., is said to be the result of removal of water from the lens.

519. DEUTSCHMANN. The action of hygroscopic substances on the crystalline lens. (*A. f. d. ges. Phys.*, vol. xx, 8 and 9.) He claims priority against Heubel; the formation of cataract in diabetes mellitus cannot be explained by removal of water by the fluids of the eye, which contain a great deal of sugar themselves.

520. PESCHEL. Experiments on the periscopy of the crystalline lens. (*A. f. d. ges. Phys.*, vol. xx, 6 and 7.)

521. SCHÖLER. Experimental studies on the secretion of fluids from the eye. (*A. f. O.*, vol. xxv, 4; Comp. *A. O.*, vol. ix, p. 103, No. 75.)

522. ZEHENDER, MATTHIESEN AND JACOBSEN. The indices of refraction and chemical composition of cataractous lenses. (*Z. M.*, vol. xvii., p. 307.)

523. ZEHENDER. Index of refraction and chemical composition of cataractous lenses. (*Report on the 12th meeting of the Ophthalm. Society, Z. M.*, vol. xvii, *supplement.*) Cataractous lenses generally have a higher refractive index than normal lenses, the cholesterine is not distinctly increased in all forms of cataract as was believed from former researches. There are forms of cataract in which no, or very little, cholesterine can be demonstrated.

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524. AITKEN. A new kind of after-images. (*Journ. of Anat. and Phys.*, April, 1879.) If we look at a moving and then at a fixed object, the latter appears to be moving in the opposite direction of the real motion. (Has been known long.)

525. ALBINI. Typographical scales for the test of acuteness of vision. (*Atti dell' Assoz. Ottalmol. Ital., Napoli*, Settembre, 1879. Comp. also *A. O.*, p. 104, No. 89.)

526. ALBINI has (*ibidem*) reported new observations on visual purple.

527. ARAGO recommends metrical decimal scales, especially for the determination of the acuteness of vision and refraction of soldiers. (*Revista de Medicina ; Chirurgia Practica*, 1879.)

528. AUDIGIER. De la perception normale des objects renversés sur la rétine et explication d'une illusion d'optique. (Presented to the Acad. des Scienc., Sept. 22, 1879. *Comp. rend. hebd. des séances de l'acad.*, 1879, No. 12.)

529. CINTOLESI. Intorno alle immagini accidentali o suggettive. (*A. d'Ott.*, 1879, vol. viii, 2 and 3.) He comes to the following conclusions: 1. At every point of the retina there are elements which, when irritated separately, cause the perception of red, green and violet. 2. If a special kind of light irritates the corresponding retinal elements, the irritation is transmitted sympathetically more or less to the others, and, as soon as in the former, after a maximum of sensibility the sensation steadily decreases almost to insensibility, the irritability of the other elements will be increased, reach a maximum, decrease again, and finally there will be a state of rest in which the retina had been before the irritation. 3. During these changes of irritation in the elements originally vibrating and in those which are sympathetically irritated, there are intermediate stages in which we perceive corresponding sensations of light, that is, we unite the different percep-

tions to a single one. 4. The modifications of the visual purple by the different kinds of light, are by the mind brought into relation with the cause of these modifications, if the terminations of the nerves which constitute the excitable elements, are under normal conditions. They can, however, be perceived in another manner, if these conditions are not present ; and in this case the mind interprets only the modifications of those elements which are in direct relation to the brain, that is, of the sensitive terminations of the optic nerve.

530. KOSMINSKI. The examination of the visual apparatus in regard to refraction, accommodation, and acuteness of vision. (*Medycyna*, 1879.)

531. MAUREL. Appréciation de l'acuité visuelle sous le rapport de l'aptitude professionelle chez les soldats et les marins. (*Baillière, Paris*, 1879.) It contains 16 pages and a chromolithographic plate.

532. MAUREL. De la détermination expérimentale de l'acuité visuelle. (*Soc. de Biol., Gaz. Méd. de Paris*, No. 38.)

533. PLATEAU. Un mot sur l'irradiation. (*Bulletins d l'Acad. Roy. des Sc. de Belg.*, 1879, No. 7.)

534. POUCHET. Note sur les moindres images rétiniennes. (*Soc. de Biolog.*, July 12th. *Gaz. Méd. de Paris*, No. 39.)

535. REICH. The acuteness of vision of the Georgians. (*C. f. A.*, p. 301.) The acuteness of vision is in 83.5 per cent. greater than 1 ; in 32.1 per cent., about double, and in 3.5 per cent., even more than double.

536. REICH. High degree of acuteness of vision in the army. (*Medizinski Westnik*, No. 41. On high degrees of vision, comp. also this bibliog., Nos. 585, 602, 618.)

537. RENTON. Note on a method for measuring the diameter of the retinal vessels. (*Journ. of Anat. and Phys.*, vol. xiii.)

538. SNELLEN. Optotypes. 6th edition.

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539. GOLTZ AND V. MEHRING. The functions of the cerebrum. (*A. f. d. ges. Phys.*, vol. xx, 1.) Goltz states in regard to the localization of the centre of vision, that dogs, after the removal of the occipital lobes, permanently show a greater disturbance of vision than dogs after the loss of an equally large portion of both parietal lobes, which, however, is followed by a permanent reduction of sensation.

540. MUNK. Physiology of the visual region of the cortex cerebri. (*Berl. phys. Ges.*, July 4, 1879; *A. f. Anat. u. Phys., physiol. Abth.* 5 u. 6; *C. f. A.*, p. 255.) The outermost lateral portion of each retina corresponds to the outer lateral part of the visual region of the same side. The much larger remaining portion corresponds to the much larger part of the visual region of the opposite side, and we can project the retina in such a manner upon the visual region, that the remaining lateral portion of the retina corresponds to the lateral margin of the remaining visual region, the inner margin of the retina to the medial margin of the visual region, the upper retinal margin to the anterior margin of the visual region, the lower retinal margin to the posterior margin of the visual region.

541. WILSON demonstrates some philosophical, rather abstruse ideas about the development of vision. (*American Homœopathic Ophth. and Otol. Soc.*, June 24 and 25, 1879, Philadelphia, 1879.)

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542. ACKROYD. On a visual phenomenon and its explanation. (*Nature*, 1879, No. 515.)

543. BERLIN. Anomalies of refraction and accommodation in the eyes of animals. In a large number of different domestic animals the refraction was mostly hypermetropic. Myopia was sometimes found in horses. In most of the larger animals irregular astigmatism of the lens could be demonstrated. (*Ophth. Section der Naturforscher-Versammlung in Baden-Baden*, Sept., 1879, *Z. M.*, 1879, p. 493.)

544. BERLIN. Estimation of distance in animals which are blind in one eye. (*Ibidem.*)

545. BOUCHARDT. La lumière et son action sur l' œil. (*A. d'O.*, July-August.)

546. CLASSEN. How do we estimate our relations to objects in space by the sense of vision? (Preger's Collection of "Treatises on Physics," 2d series, No. 5, January, 1879.)

547. CUIGNET. Vision rouge. (*R. d'O.*, September, 1879.) A flame seen through a corneal opacity appears red.

548. EDER. The chemical actions of colored light and photography in natural colors. (Vienna, 1879.) We are interested only in the first part, from which we quote the following conclusions: 1. The light of each color from the extreme violet to the extreme red, and also the invisible ultra-violet and ultra-red rays

can produce chemical actions. 2. Rays which have a chemical action upon a substance must also be absorbed by it; the chemical action of light is in close relation to the optical absorption. 3. Each kind of light can be oxidizing and deoxidizing according to the nature of the percipient substance. 4. In general, we may say that the red light acts mostly oxidizing upon metallic combinations, but the violet light mostly deoxidizing. Organic combinations, especially colorless ones, are mostly strongly oxidized by the violet light; coloring substances are mostly strongly oxidized by the rays of light which they absorb. In all cases the chemical action of colored light is subject to the law that those rays act more powerfully which are strongly absorbed by the percipient substance. 5. Not only the absorption of light by the illuminated body, but also the absorption by admixed substances, is of importance in the chemical action of light. The sensibility to light of the former is frequently increased for those rays of light which are absorbed by the latter ("optical sensibilizers"). 6. When a substance, which chemically fixes the elements set free by the light, is admixed to a light-perceiving body, it favors the decomposition by the light in consequence of "predisposing affinity;" such bodies are called "chemical sensibilizers" (chemische Sensibilisatoren). 7. The direct decomposition of a substance is not proportionate to the latent action of light. 8. The effect of the solar spectrum varies considerably with the condition of the atmosphere; absolute numbers of the chemical effect of the spectral colors, therefore, cannot be given without difficulty.

549. GALEZOWSKI observed red-seeing in patients operated on for cataract. (*R. d'O.*, September, 1879; comp. *A. O.*, vol. ix, p. 104, No. 79.)

550. HERMANN. The refraction of obliquely incident rays, with especial reference to the eye. (*A. f. d. ges. Phys.*, vol. xx, 6 and 7.)

551. HIRSCHBERG. On refraction ophthalmoscopes. (*Ophth. Hosp. Rep.*, vol. ix, 3.)

552. HORSTMANN. Refraction in children. (*Report of the 12th Meeting of the Heidelberg Ophthalmic Society. Z. M.*, vol. xvii, supplement.) Among 96 eyes, 74 hypermetropic, 13 emmetropic, 9 myopic.

553. JAVAL. Physiologie de la lecture. Suite. La lecture dans ses rapports avec les amétropies. (*A. d'O.*, July-August, November-December, 1879.)

554. JAVAL. Les livres scolaires et la myopie. (Presented to the Acad. de Méd., November 4, 1879.)

555. KRÜSS. The defects of the images by bicylindrical lenses. (*Verh. d. naturw. Versamml. zu Hamburg*, 1879, p. 104.)

556. MATTHIESEN. The geometrical figure of the theoretical retina of the periscopic schematic eye. (*A. f. O.*, vol. xxv, 2$_4$)

557. MALAREWSKY, at the meeting of the Russian Society for Hygiene, spoke of "a page of a book and its influence upon the scholar." He recommends to print white letters upon black background.

558. MOURELO. The mechanical effects of light. (*Revista de Espana*, 1879, July.)

559. NAGEL. The motion of fusion according to metrical units. (*Naturforscher-Versamml. zu Baden-Baden*, 1879. *Z. M.*, vol. xvii, p. 492.)

560. PELTZER. On optometers and the examination of eyes in the recruitment of the army. (*Deutsche militärärztl. Zeitschrift*, H. 12.)

561. PESCHEL. Computation of the cardinal points in the diagrammatic eye. (*C. f. A.*, July, 1879.)

562. POLE. Hering's theory of the vision of light and colors. (*Nature*, No. 521–523.)

563. PROMPT. Sur une illusion d'optique. (*Gaz. Méd. de Paris*, No. 37. Comp. *A. O.*, vol. ix, p. 106, No. 112.)

564. RASMUS and WAUER. Mathematical theory of the periscopy of the human eye. (*A. f. d. ges Phys.*, vol. xx, 4 and 5.)

565. ROBERTS speaks of the necessity of using atropine in the determination of refraction. (*Med. Bull.*, Phila., 1879, vol. i, 12.)

566. SANTI. De l'introduction du système métrique dans le mesure de la réfraction. (*Rec. de Mém. de Méd.*, Mil.. 1879, vol. xxxiv.)

567. SCHLESINGER. Binocular vision of squinting people before and after the operation. (20. *Jahresvers. ungarischer Aerzte. u. Naturforscher*, August 29, 1879.) In no form of squint that kind of binocular combination of action is developed which admits of real binocular vision.

568. TREICHLER holds the present method of school education responsible for the development of myopia. (*Naturoforscher-Vers. zu Baden-Baden*, 1879, *Z. M.*, vol. xvii, p. 493.)

569. TRÈLAT. Distribution de la lumière dans les écoles et aménagement de l'insolation dans les classes. (*Ann. d' Hyg. Publ.* 1879, September.)

570. VALENTIN. Further investigations of the refractions of animal tissues. (*A. f. d. ges. Phys.*, vol. xx, p. 283.)

WAUER. Comp. No. 564.

571. WEISKER. The optical defects of the eye. (Rathenow, 1879.)

572. ZÖLLNER. The scale photometer; a new instrument for the mechanical measurement of light, with contributions to the history and theory of mechanical photometry. (Leipzic, 1879.) Zöllner's photometer is constructed after the principle of Crooke's radiometer.

573. AITKEN. Color-blindness. (*Nature*, No. 522.)

574. ANESHÄNSEL. The detection of color-blindness. (*Arztl. Mitth. aus Baden*, vol. xxxiii, 11.)

575. BECKER. A case of congenital, one-sided, total color-blindness. (*A. f. O.*, vol. xxv, 2.) This first accurately and fully-examined case of monolateral color-blindness refers to a girl of 17, in whose family there were color-blind males.

576. BERRY. Remarks on the examination and classification of cases of color-blindness. (*Edinburgh Med. Journ.*, October, 1879.

577. BRIBOSIA. Among 825 persons, about three per-cent. were color-blind. (*Internat. Med. Congr.*, Amsterdam. Z. M., vol. xvii, p. 406.)

578. BRÜCKE. Some consequences of the Young-Helmholtz theory. (*Kais. Acad. d. Wissensch. zu Wien*, 3 Juli, 1779. lxxx. Bd. *d. Sitzungsber. d. Kais. Acad.*, iii Abth., Juliheft, 1879.) The correctness or incorrectness of Young-Helmholtz's theory has thus far not been demonstrated by the examination of color-blind persons. Not one of the reasons brought forward against Helmholtz's theory from the examination of color-blind persons, is conclusive.

579. BURNETT. Results of an examination of the color-sense of 3,040 children in the colored schools of the district of Columbia. (*A. O.*, vol. viii, p. 191.) Among 1691 colored girls, two were color-blind =0.11 per-cent.; of the 1349 colored boys, 22 were color-blind =1.6 per-cent. Compared with the percentage of color-blindness in school-children found by Magnus, the negroes show a smaller percentage of color-blindness.

580. BURNETT. A systematic method for the education of the color-sense in children. (Washington, Sept. 25, 1879.) He comes to the following conclusions: The reduced color-sense which does not depend upon an abnormal structure of the color-perceiving apparatus, but only upon an insufficient development of a domant force, can be sharpened by systematic education. The really color-blind patient cannot be improved by training, but it may surely be expected that by practice continued during several generations the tendency to color-blindness can be considerably weakened. Burnett's system of training is essentially only a modification of the one proposed by Magnus. The colors which Magnus prepares by lithography, are furnished by colored worsteds, which are arranged on a plate, as follows: first, red, green, blue, as the three fundamental colors; then, 3 *cm.* below these: purple, orange, yellow, pale-red, brown, gray. Each stripe of color should be 18 *cm.* long and 35 *mm.* broad. Besides, there is a number of skeins of worsted of the same colors as those on the plate. First the colors on the plate are shown and named by the teacher, and the pupil is then examined. The shades of the different colors are then explained and are selected from the samples of worsted.

581. CAMERON. Color-blindness. (*Dublin Journal*, Sept., 1879.

582. CARL. A contribution to the statistics of color-blindness. (*C. f. A.*, Dec., 1879.) Among 2504 pupils 61=2.4 per cent. were color-blind. In the higher schools, color-blindness was not as frequent as in the lower schools; of 1504 pupils of the higher schools, 26 were color-blind, *i.e.*, 1.7 per-cent.; of 1,000 in the lower school 35=3.5 per-cent. were color-blind. This is a confirmation of similar observations by Fontenay, Holmgren and Magnus. He pleads for the union of red-blindness and green-blindness into one form. Holmgren's method was used: Cohn's modification, that is, the leaving out of test I, can not be recommended.

583. COHN. Comparative determination of the acuteness of vision and the perception of colors by daylight, gaslight and electric light. (*A. O.*, vol. ix, 1, p. 51.)

584. COHN. Acuteness of sight and color-sense of the Nubians. (*C. f. A.*, July.)

585. COHN. Quantitative determination of the color-sense in Europeans and Nubians. (*Schles. Ges.*, August 1, 1879. *Schles. Zeit.* No. 372, and *Allg. Med. Centralzeit.*, August 30, 1879.) The

color-sense of the Nubians is normal, but their nomenclature is incomplete. Acuteness of sight much higher than 1.

586. COHN. Determination of the color-sense by direct sunlight and by electric light. (*Ber. d. 12 Vers. d. Ophth. Ges. Z. M.*, vol. xvii, p. 6.) The distances at which most colors are recognized by electric light, are considerably greater than by good daylight.

587. COHN. Quantitative determinations of color-sense. (*A. O.*, vol. ix, p. 61.)

COHN. Comp., No. 598.

588. CROS. Les couleurs, le chromomètre et la photographie des couleurs. (*Journ. de Physique*, vol. viii. 1879.)

589. DONDERS. Pseudo-isochromatic patterns for the detection of color-blindness. (*Ber. d. 12 Vers. d. Ophth. Ges. Z. M.*, vol. xviii, p. 171.) The wool patterns which are pseudo-isochromatic to the color-blind person, are wound around a piece of wood in striped patterns, and the patient has to count the stripes. The stripes have the thickness of two threads of wool and correspond to the broad lines of ix of Snellen's test-types. With this method three kinds of pattern are obtained, one which is not, or only with difficulty, recognized by those red and by those green blind; a second one, the stripes of which are easily recognized by those red blind, but with difficulty or not at all by those green blind; and a third one, the stripes of which are easily seen by those green blind, but not at all, or only with difficulty, by those red blind.

590. DONDERS, at the International Medical Congress at Amsterdam, presented for discussion a schedule devised by himself for the examination of the vision of railroad employés. (*Z. M.*, vol. xvii, pp. 406 and 409; *C. f. A.* p. 327.)

591. EICHLER. The doctrine of colors with 110 plates; also rules for instruction. (Vienna, 1879.)

592. EVERETT. Color-vision and color-blindness. (*Nature*, No 525.)

593. GATSCHET. Adjectives of color in Indian languages. (*The American Naturalist*, August, 1879. A German translation in *Zeitsch. f. Ethnologie*, vol. xi, H. 4 u. 5.) Seven Indian tribes of North America were examined with colored strips of paper. The expressions for green and yellow, red and yellow, yellow and brown, brown and red, were sometimes not distinctive by the Indians of North America as well as by those of South America;

green and yellow were most frequently expressed by the same word. Otherwise the Indians distinguish very many shades of color.

594. GEOFFROY. De la connaissance des couleurs dans l'antiquité, examen de la théorie du Dr. Magnus. (*Union Méd.*, July, 1879, Nos. 82 and 86.)

595. v. HIPPEL. Color-blindness. (*Verein f. Wissensch. Heilk.*, Febr. 3, 1879. *Berl. Klin. Wochenschr.*, No. 39, 1879.)

596. HIRSCHBERG. A modification of the spectroscope for the detection of color-blindness. (*Phys. Geselloch. zu Berlin*, Jan, 17, 1879. *Deutsche Med. Wochenschr.*, No. 37, 1879. Comp. *A. O.*, vol. ix, 1, p, 108, No. 138.)

597. HOLMGREN. Prof. Cohn's investigations on color-blindness. A critical reply. (*Upsala Läk.*, Apr., 28, 1879. As separate pamphlet, *Upsala*, 1879.)

598. COHN. Prof. Holmgren's investigations on color-blindness, and his mode of controversy. (*Breslau*, 1879. *Morgenstern.*)

599. JEFFRIES. The railroad commissioner's investigation of color-blindness. (*Boston Advertiser*, Nov. 1, 1879.)

600. KALISCHER. The education of the human senses; especially of the color-sense. (*Gegenwart*, vol. xvi, No. 32.) He urges the training of the organs of sense and recommends for the color-sense Magnus' color-plates.

601. KEYSER. Report of an examination of railroad men for color-blindness. (Pennsylvania State Med. Soc., May 22. Transact. Pennsylv. State Med. Soc., p. 642.)

602. KOTELMANN. The eyes of 9 Laplanders, 3 Patagonians, 13 Nubians, and 1 Negro from the White Nile. (*Berl. Klin. Wochenschr.*, 1879, No. 47.) Color-sense well developed; names of colors uncertain. Acuteness of sight much greater than 1.

603. v. KRIES and KÜSTER. Congenital color-blindness. (*Arch. f. Anat. u. Phys., Physiol. Abth.*, 1879, p. 513.) The confusions made by the color-blind eye do not refer only to the colors, but also to their brilliancy; to the green-blind blue-green and blue-purple, to the red-blind blue-green and red-purple appear identical. Color-blind persons confound such parts of the spectrum which are not far apart, and in which, therefore, the differences of intensity are not yet perceptible.

604. MACÉ and NICATI. Recherches sur le Daltonisme. (*Compt. rend. de l'Acad.*, 1879, No. 17.) They distinguish a red, green, and violet blindness. Of men, 3.57 per cent. were color-

blind; among 241 women only 1. The examinations were made after Holmgren's method.

605. MAGNUS. The systematic education of the organs of sense, especially of the color-sense. (Ausland, 1879, No. 36.)

606. MANZ. Some effects of fuchsine glasses. (*Ophth. Section der Naturf. Vers. zu Baden-Baden. Z. M.*, vol. xvii, p. 486.) Green-red blind persons assort correctly with fuchsine glasses. The visual field for red is generally increased by a fuchsine glass.

607. MARTY. The question of the historical development of the color-sense. (Vienna, 1879.) Man is said to have had a sensation of colors at all times, but lower classes of animals may gradually have gained the faculty of qualitative perception of light, and then transmitted it to succeeding generations. But that to man a gradual development of his judgment of colors, and an alteration of his sensation of colors, are accorded.

608. MAUTHNER. Nomenclature and theory of color-blindness. (*Gesellsch. d. Aerzte zu Wien.*, 31 Octob., *Wiener Med. Woschenschr.*, No. 45.) He divides the disturbances of the color-sense into: Achromatopsia, *i.e.*, the spectrum appears colorless, and into dichromatopsia, *i.e.*, the spectrum appears in two colors; the latter condition is again divided into xanthokyanopsia, in which the spectrum is blue and yellow, and into erythrochloropsia, in which the spectrum is green and red. The simplest means to detect color-blindness are said to be pseudoisochromatic powders.

609. MAUTHNER. Test of the color-sense. (*Wiesbaden, F. F. Bergmann*, 1879.)

610. MEYER. The relative brightness of colors in sunlight, gaslight and electric light. (*Schles. Gesellsch.*, July 27, *Schles. Zeitung*, No. 356.)

611. NETOLICZKA. Researches on color-blindness and myopia. (28. *Jahresber. d. steiermærk. Landes-Oberrealschule über das Studienjahr* 1878-79, *Graz*, 1879.) Holmgren's test is said to be the best Among 1,024 boys, 41 were color-blind (completely and incompletely); in 31 the color-sense was reduced; 71 were not trained, that is, they sorted correctly, but only after some hesitation. The 283 girls had all a normal color-sense. The division into red- green- and violet-blindness is preferred. In 15 color-blind boys Delbœuf's fuchsine-stained glasses were employed, without, however, correcting the color-blindness.

NICATI. Comp. No. 604.

612. NIKITIN. The quantitative determination of the color-sense. (*Dissert.*, Petersburg, 1879.) He has tested Dor's tables as to their value, and has come to the following conclusions: 1. Tables are not strictly correct; the color of Dor's objects was in almost every case recognized at a greater distance than has been stated by Dor; the visual angle, under which colored objects are recognized, is therefore smaller than found by Dor. 2. The determination of degrees of the perception of colors by the size of the visual angle after Dor's method, is only accurate at a certain size of the objects; the distance at which colors are recognized is not proportionate to the increase in size of the colored object; at greater distances the color-sense is relatively less acute than at a smaller distance. 3. With the great difference of the color-sense in normal eyes, Dor's plates cannot be used for the determination of pathological changes of the color-sense. 4. The visual angle differs for different colors —the size of the object being always the same—; it is smallest for orange, yellow and green; then comes red, and finally violet and blue. 5. The size of the visual angle changes with the illumination.

613. NUEL. Des altérations acquires du sens chromatique. (*A. d'O.*, 1879, July–August.) Des altérations du sens chromique (*Journ. d. Sc. Méd. de Louvain*, vol. iv, Louvain, 1879.)

614. PLÜGER. Methods of examination for color-blindness. (*Vortrag auf der* iv. *Vers. d. arzth centralvereins u. d. Soc. Méd.* de la Suisse. *Correspondenzbl. f. Schweizer Aerzte*, vol. ix.) Stilling's plates are entirely unreliable; also Cohn's embroidered plates. Daae's plate makes rather high demands on the intelligence of the patient. Maxwell's disc is very desirable for the accurate study of a single case of color-blindness, but it takes too much time for the examination of numerous persons. The polariscope can be recommended, but the instrument is much too expensive. Holmgren's test and Pflüger's crape contrast method are best adapted for the examination of greater numbers. The methods in which spectral colors are used, are especially suited to control examinations.

615. POLE. Color-blindness. (*Nature*, No. 516.)

616. v. REUSS. Color-blindness and its relations to railroads, especially of Austria and Hungary. (*Neue freie Presse*, Sept. 4.)

617. SCHRÖDER. The development of the color-sense in the human eye. (*Berl. Klin. Wochenschr.*, No. 36 *u.* 37.) The

theory of the development of the color-sense is correct, but the purely physiological evidence leads to false conclusions in regard to the periods in which this development has taken place.

618. STEIN. Some interesting notes about the Nubians. (*Frankforter Zeitung*, No. 213.) They distinguish the ground colors like the European, but they have no accurate and well-trained color-sense, and an uncertain nomenclature. The acuteness of vision is more than double.

619. STILLING. Color-blindness. (*Bericht der* 12, *Vers. d. Ophth. Ges. Z. M.*, vol. xvii, p. 170.)

620. v. STRAUSS. The names of the colors blue and green in ancient China. (*Zeitschr. d. Deutschen Morgenlandischen Ges.*, vol. xxxiv, 3.)

621. SWANZY. Color-blindness. (Brit. Med. Assoc., Cork, Aug. 5–8, 1879. *Brit. Med. Journ.*, Octob. 4.) Among 1,230 males, 82=6.6 per cent. were color-blind ; among 90 females not any. Holmgren's method was used.

622. VIRCHOW finds the color-sense well developed in the Laplanders, but they have a deficient nomenclature. (*Berl. Ges. f. Anthrop.*, March 15, 1879. *Zeitschr. f. Ethnologie*, 1879, Sept. 3, p. 146.)

623. BELLAMY. A suggestion on the action of the oblique muscles of the eyeball. (*Nature*, No. 511.)

624. DUVAL. Sur l' enervation des mouvements conjugés des yeux. (*Soc. de Biol.*, Jan. 28, 1879. *Gaz. Méd. de Paris*, No. 30.)

625. HERING. Muscular contraction sounds of the eye. (*Wiener Acad. Sitzusguber.*, vol. lxxix, p. 137.)

626. REICHEL. The morphological changes during the action of the lachrymal gland. (*Arch. f. Microsc. Anat.*, vol. xvii, 1.) The irritated lachrymal gland has somewhat smaller granular cells, of a dull appearance, in consequence of the albuminous contents.